PART IV: Environmental Consequences of Alternatives

TABLE OF CONTENTS Page

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

This section evaluates the environmental consequences of each boundary, regulatory and management alternatives for the Sanctuary including the status quo (no action). The consequences of each action are discussed in the context of the predicted impacts to the affected activities and existing jurisdictions, and resources and qualities of the Sanctuary.

Appendix C evaluates each boundary alternative with respect to the distribution of colonial seabirds, marine mammals, invertebrates and fish. Because the study conducted by the Strategic Environmental Assessment Branch of NOAA was undertaken prior to the publication of the DEIS/MP, the Strait of Juan de Fuca is not part of the analysis presented in Appendix C. Pursuant to comments on the DEIS/MP, NOAA has undertaken a comprehensive analysis of the resources and uses of the Strait of Juan de Fuca. This analysis is presented in the following discussion of boundary alternative 4.

I. Section: Boundary Alternatives
A. Introduction

The five boundary alternatives analyzed will protect resources and attributes of the ecosystem off the Olympic Coast to varying degrees of aerial extent. Each boundary alternative is described on the basis of the resources and human uses encompassed by the alternative. The environmental consequences of each boundary alternative are discussed in the context of the preferred resource protection and management regime.

B. Boundary Alternative 1.

Boundary alternative 1 extends from Koitlah Point just west of Neah Bay to Pt. Grenville and seaward to the three nautical mile limit of state jurisdiction. This boundary encompasses an area of 315 sq. nautical miles. This boundary alternative focuses primarily on land/sea interactions and the protection of seabird colonies and pinniped haul-out sites. Most of the coast between Cape Flattery and Point Grenville is dominated by steep cliffs rising abruptly from shore 50 to 300 feet above a wave-cut platform. Interspersed among these cliffs are pocket beaches. Small islands, sea stacks, and rocks dot the coastal and offshore waters. Most of the rocks and islands are included within the boundary of the National Wildlife Refuges and Olympic National Park.

There is very little human development along this coastal boundary. The Makah, Quileute, Hoh and Quinault Tribes have reservations adjacent to the coastline and the remainder of the coastline is under the jurisdiction of the Olympic National Park and Washington State (between Pt. Grenville and Copalis Beach). The coastal area of the Makah and Quinault Reservations encompass the largest coastal areas of all four tribes, and their coastal regions adjacent to this boundary alternative are dedicated wilderness areas. Within the watersheds that drain into this coastal boundary, the two principal land uses are recreation associated with the Olympic National Park) and timbering operations. There is anecdotal evidence that upland forest practices are pressuring coastal resources such as kelp beds and estuarine areas. The largest sources of freshwater discharges are the Quinault, Queets, Hoh and Soleduck rivers.

Many tourists visiting the Olympic National Park travel to the coastal areas to participate in sports fishing, birding, hiking, kayaking, and razor clam digging. Tourism is economically important to the tribes. The tribes also depend on the coastal and intertidal resources for subsistence hunting and gathering. Degradation of the coastal environments would severely impact tribal economies.

Treaty and non-treaty fisheries are important human

activities in this boundary. Treaty fishers use gillnets in the mouths of the coastal streams to harvest salmon returning to their spawning grounds. Treaty and non treaty fisheries for salmon, groundfish and shellfish occur offshore.

There are numerous archeological resources within this boundary which are significant to the coastal tribes. These include burial grounds, and other areas of cultural and spiritual significance. The Makah Archeological Museum documents some of the tribal archeological history of the area. Many artifacts recovered from the recently excavated Ozette Village are preserved and displayed at the museum. There have been numerous shipwrecks on the rocks and islands, however most have disintegrated from the high wave energy in this region. There is evidence that during the period of the last glaciation, there were human settlements seaward of the present day coastline. However, boundary alternative 1 excludes much of the region believed to contain offshore archeological resources.

Boundary alternative 1 includes Sealion Rock. The Navy has permission from the U.S. Fish and Wildlife Service to use Sealion Rock as a practice bombing target. Whidbey Island and Pacific Naval Fleet A6 bombers drop inert bombs on the island. While the Navy has voluntarily ceased their practice bombing activities over Sealion Rock, their ability to use Sealion Rock in the future depends upon the outcome of a lawsuit brought against the Navy and the USFWS. The lawsuit addresses the legality of the permit issued by the Department of Interior under which the Navy is authorized to use Sealion Rock.

There is minimal vessel traffic in this region due to the rocky nature of the shoreline and strong wave action. There may be an occasional tug and barge transiting the coast close to shore where there are few rocks, but most are likely to traverse seaward of the refuges. This boundary precludes the Sanctuary from addressing vessel traffic which, although predominately outside of 3 miles, threatens the coastal ecosystem.

The benthos off the coast is predominately sand which originates north of Point Grenville from sediments transported by the Strait of Juan de Fuca and upland drainage basins. South of Pt. Grenville sediments originate from drainage basins emptying into the Columbia River. Overlaying the bedrock along many areas of the coast are gravel deposits laid down by glacial streams during glaciation of the Olympic Mountains. The most extensive gravel deposits are found off Cape Flattery and just north of the Quinault River. Boundary alternative 1 would encompass the deposits off the Quinault River, but exclude those off Cape Flattery.

Extensive macrocystis kelp beds extend from Koitlah Point to Cape Alava and into the Strait of Juan de Fuca to Observatory

Point and boundary alternative 1 encompasses that portion of kelp on the outer coast. There is anecdotal evidence that in the recent past the kelp beds extended further south than Cape Alava. High sedimentation is believed among some to be the cause of the decline in kelp biomass. A lack of monitoring activities along the outer coast makes it difficult to substantiate this observation. Boundary alternative 1 includes the kelp resources along the outer coast, but excludes the extensive and diverse kelp beds located in the Strait of Juan de Fuca.

NOAA's analysis demonstrates that boundary alternative 1 is one of the least significant areas in the study are with respect to total aggregate fish resources (see Appendix C). Some commercial salmon, crab, and recreational groundfish fisheries occurs in this boundary, however significant fish resources and harvesting areas are excluded. Boundary alternative 1 includes much of the recreational fishing areas for bottomfish, some of the recreational areas for salmon, and excludes most of the halibut fishing grounds. This boundary alternative also excludes the seaward extent of the commercial salmon fishing grounds.

Boundary alternative 1 rates most significant with respect to invertebrates (Appendix C). This analysis, however, does not include the Strait of Juan de Fuca which has remarkable subtidal invertebrate communities. In fact, the intertidal areas of the Olympic Peninsula represents some of the most diverse intertidal habitats in the world. The intertidal habitats have been studied extensively at Tatoosh Island by researchers from several Universities.

When compared to the other boundary alternatives, Boundary alternative 1 is significant for offering haul out sites and rookery areas for pinnipeds, but, excludes many of the haulout sites in the Strait of Juan de Fuca. It is, however, one of the least significant boundary alternatives for marine cetaceans. This boundary does not encompass the foraging habitats or migration routes of the marine mammals and thus is incomplete from an ecosystem perspective.

This boundary alternative includes most of the colonial seabird nesting sites in the study area, and some of the largest number of seabird colonies in the contiguous United States. A small number of colonies exist slightly east of Koitlah Point outside of this boundary alternative. Boundary alternative 1 is limited in that it does not include the foraging areas of the seabirds. Seabirds such as the storm petrel forage for days at the shelf edge during the nesting season. Other seabirds forage at varying distances from the nesting sites. Thus, this boundary alternative offers no protection for these critical foraging and nesting habitats from the impacts of oil and gas exploration and development, or vessel traffic accidents. The coastal area of this boundary alternative is remote with few access points. This

remoteness, coupled with the extreme sensitivity of rocky intertidal habitat, pinnipeds, and colonial seabirds, makes this coastal region particularly vulnerable to impacts from offshore development.

The few airstrips along the coastal boundaries of the Sanctuary include the Copalis Beach air strip (accessible at low tide when landings and takeoffs are not obstructed by driftwood), and an unstaffed airstrip at Quileute. One cargo plane daily uses the Quileute airstrip Monday through Friday. There are 40 additional operations per week at the Quileute airport. There is no radar coverage below 3000 ft and therefore no statistics available on the number of aircraft flying over the Sanctuary. Most aircraft are recreational craft or small air taxis which are believed to observe a 2000 ft. advisory over the National Park and National Wildlife Refuges. There are no altitude restrictions over the Sanctuary waters. During the nesting and breeding season, low flying aircraft present a threat to Sanctuary resources. This boundary alternative will protect the colonial seabirds and mammals of the Sanctuary by prohibiting overflights less than 2000 ft.

In summary, boundary alternative 1 surrounds some of the significant features that one can see from the shore, i.e., seabird nesting colonies, pinniped haul-out sites, part of the cetacean migration corridor, some of the kelp habitat, much of the rocky intertidal habitats and pocket beaches. It is, however, severely limited in encompassing the entire ecosystem in that is does not protect the extent of these resources, including those that exist further offshore and into the Strait of Juan de Fuca. This larger ecosystem supports the biological features visible from shore. This boundary alternative also provides no buffer against activities that could seriously impact the coastal resources.

Figures 59-62 depict boundary alternative 1 in relation to fisheries, marine mammal haulout sites, kelp habitat, seabird colonies and foraging areas, and human uses other than shipping.

C. Boundary Alternative 2

Boundary alternative 2 extends the seaward boundary of Boundary alternative 1 to the 50 fathom isobath and the southern boundary to Copalis Beach. It encompasses an area of approximately 1100 square nautical miles. It has all the features of boundary alternative 1 but includes more fishing grounds including all the crab fishing areas, and more of the commercial salmon and groundfish fishing grounds. When considering the relative density of fish species in the study area, based on commercial and recreational harvests, boundary alternative 2 contains approximately 27% of the density of fish in the study area (Appendix D). There is active vessel traffic

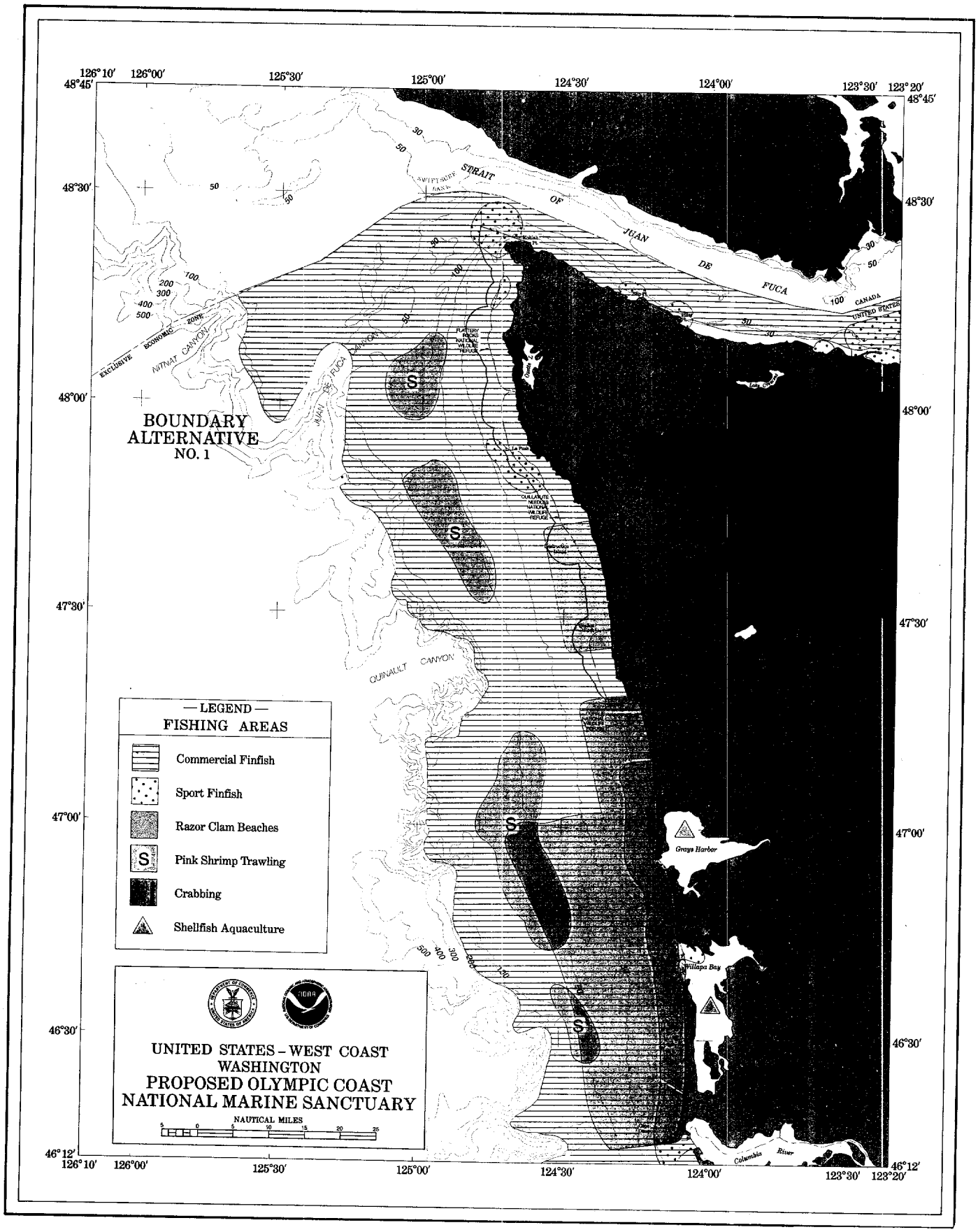


Figure 59. Boundary Alternative 1 in Relation to Fisheries.

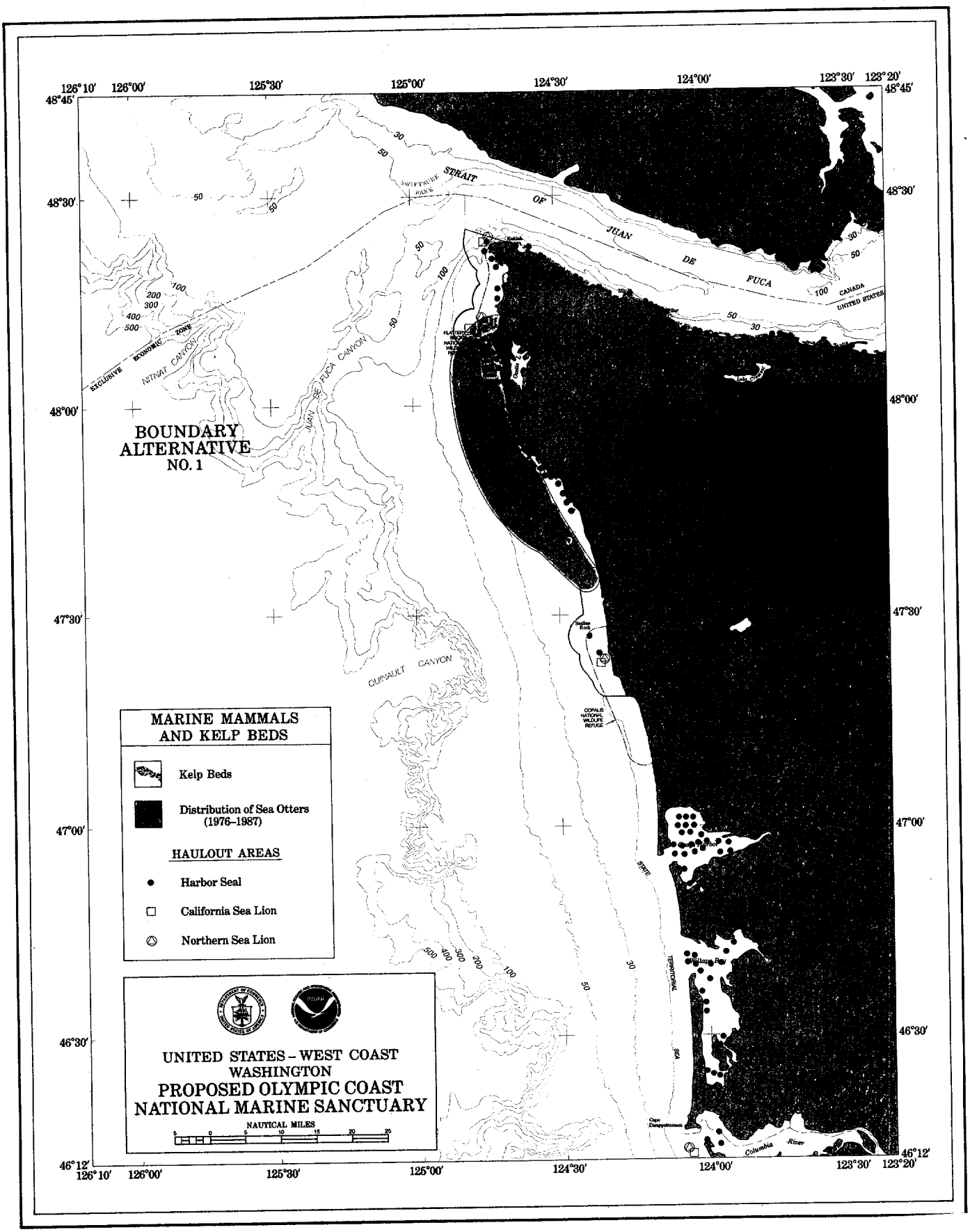


Figure 60. Boundary Alternative 1 in Relation to Marine Mammal Haulout Sites and Distribution of Kelp Habitat.

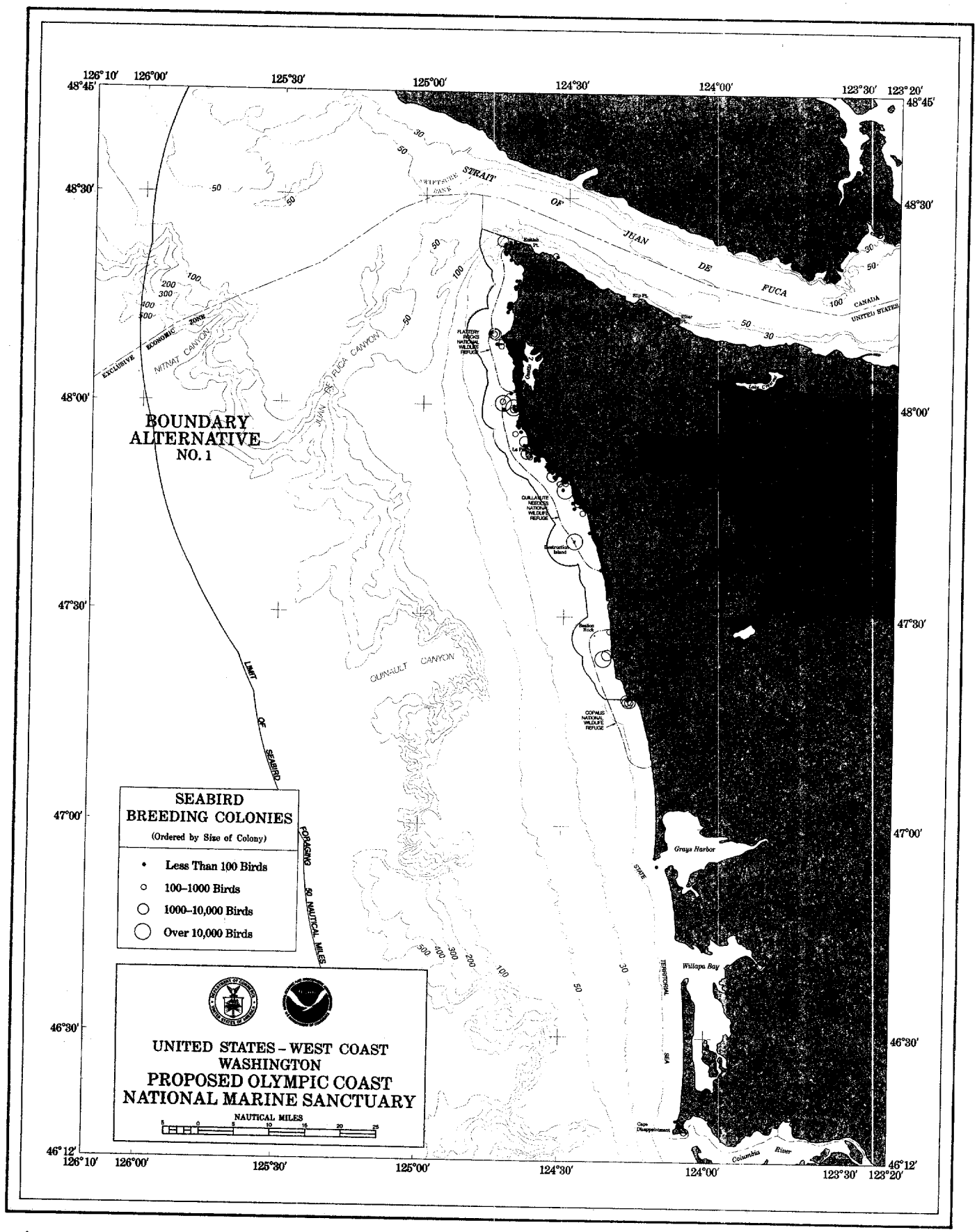


Figure 61. Boundary Alternative 1 in Relation to Seabird Colonies and Seabird Foraging Range.

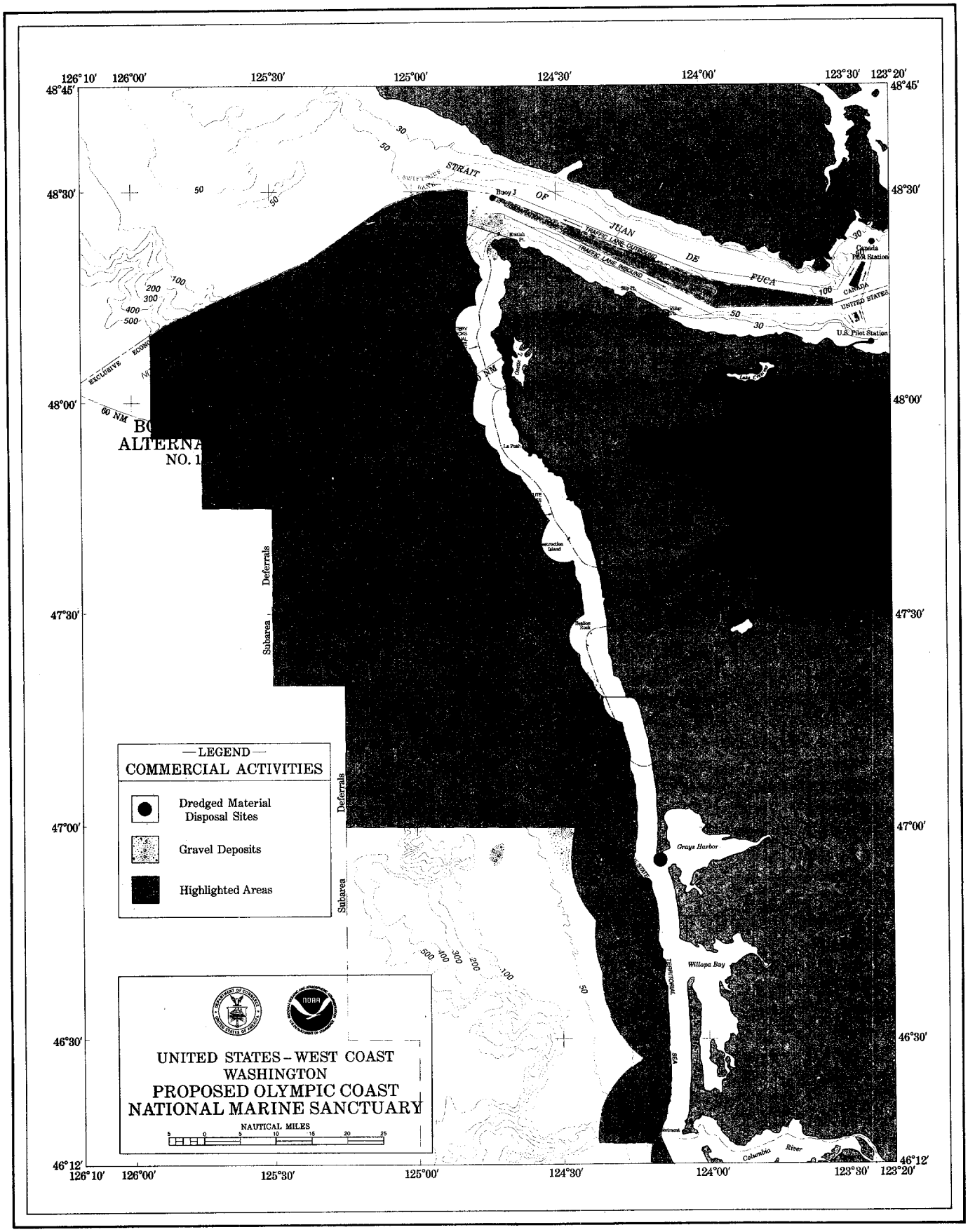


Figure 62. Boundary Alternative 1 in Relation to Vessel Traffic Management Regimes, Dredge Disposal Sites, Oil and Gas Resources and Gravel Deposits.

through this boundary including most of the tug and barge traffic, and foreign product carriers and foreign tankers. There are estimated to be oil and gas reserves under the Federal OCS.

Boundary alternative 2 contains approximately 30% of the density of invertebrates within the entire study area (excluding the Strait of Juan de Fuca). Dungeness Crab, ocean pink shrimp and giant octopus account for the majority of invertebrates within this boundary alternative.

With respect to marine mammals, boundary alternative 2 is only slightly more significant than boundary alternative 1. While it increases the area encompassing the whale migration routes, it fails to include the significant marine mammal foraging habitats and migration routes found near the edge of the continental shelf.

This boundary alternative encompasses more seabird foraging area as well. However, as with mammals, this boundary excludes the rich neretic zone environments near the shelf and canyon edges significant to seabird ecology. The boundary also excludes the intense foraging area right outside the Strait of Juan de Fuca over the Juan de Fuca canyon where millions of seabirds are found foraging during the summer months.

There are more vessels (tugs and barges and foreign product carriers) that transit the waters encompassed by boundary alternative 2 than boundary alternative 1. While domestic tankers transporting petroleum products in coastwise transit remain offshore well outside boundary alternative 2 pursuant to the voluntary agreement of the WSPA, many domestic barges engaged in coastwise traffic transit within boundary alternative 2. The Mukkaw Bay anchorage, where vessels anchor awaiting either available pilots in Port Angeles for entry into Puget Sound, or directions from home ports, is also located within boundary alternative 2. The Sanctuary would work with the Canadian and U.S. Coast Guards to undertake an educational campaign to inform mariners of Sanctuary status and the applicable regulations. This boundary alternative does not completely allow the Sanctuary program to address the impacts from vessel traffic since vessels including many tugs and barges transit further than the seaward extent of this boundary.

With respect to oil and gas development, boundary alternative 2 adds Sanctuary control over an additional percentage of the estimated oil and gas reserves in Federal water. Since there is a prohibition on oil and gas within the boundaries of the Sanctuary, this boundary provides a buffer for the coastal resources. But it does not encompass the reserves that extend seaward to the continental shelf.

In summary, boundary alternative 2 adds more resources and

uses within the Sanctuary boundary than are encompassed by boundary alternative 1. Boundary alternative 2, however, excludes a significant amount of the coastal ecosystem and areas that support uses which threaten the integrity of the Sanctuary. The relationship of boundary alternative 2 with respect to the extent of resources and uses is depicted in Figures 63-66.

D. Boundary Alternative 3

Boundary alternative 3 expands upon boundary alternatives 1 and 2 by extending the seaward boundary to the continental shelf. It encompasses an area of approximately 1805 square nautical miles. While it cuts across the head of the Quinault Canyon, it excludes the more significant Juan de Fuca Canyon. As such, it is an area enriched by enhanced upwelling from the edge of the continental shelf and the Juan de Fuca Canyon which fuels the rich ecosystem over the shelf and near the shelf edge. This area encompasses significantly more fishing grounds including salmon trolling areas and groundfish trawling areas. It includes the productive banks that surround the Juan de Fuca Canyon along its southern edge. This alternative also encompasses the pink shrimp trawling areas near the shelf edge.

Boundary alternative 3 includes approximately 42% of the fish resources (Appendix C). Lingcod, rockfish, sablefish and salmon are common fish resources within this boundary alternative. This boundary alternative encompasses a significantly increased portion of the fishing grounds for sole, rockfish, halibut, sablefish, lingcod, hake, Pacific cod, and includes the entire pink shrimp trawling areas north of Point Grenville. It also encompasses more commercial salmon harvesting areas.

Invertebrate densities (of commercial and recreational significance) included by the seaward extension of boundary alternative 3 are dominated by pink shrimp concentrations found closer to the shelf edge and also added Dungeness crab populations. This boundary alternative includes approximately 42% of the total invertebrate density calculated by NOAA (excluding the Strait of Juan de Fuca).

The seaward portion of the study area added by boundary alternative 3 is one of the most significant with respect to marine mammals. Not only does it encompass significantly more of the cetacean migration corridor, but it also adds an area where there have been sitings of such rare whales that inhabit deeper ocean environments such as the sperm whale and right whale, the latter which is the most endangered of all whales.

Boundary alternative 3 adds significantly more colonial seabird foraging areas at the shelf edge, especially for the Leach's Storm Petrel. It also encompasses the mid-shelf and

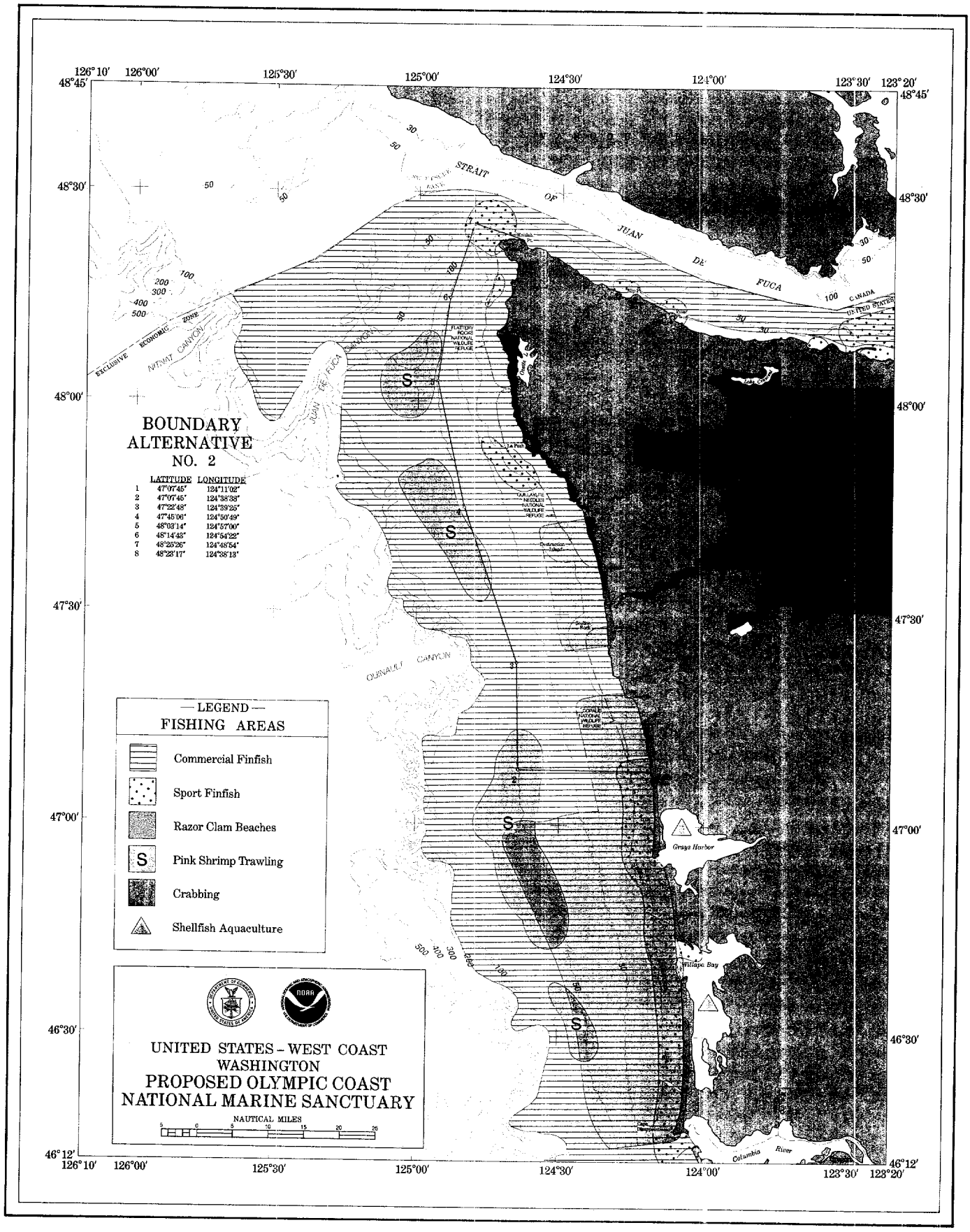


Figure 63. Boundary Alternative 2 with Respect to Fisheries.

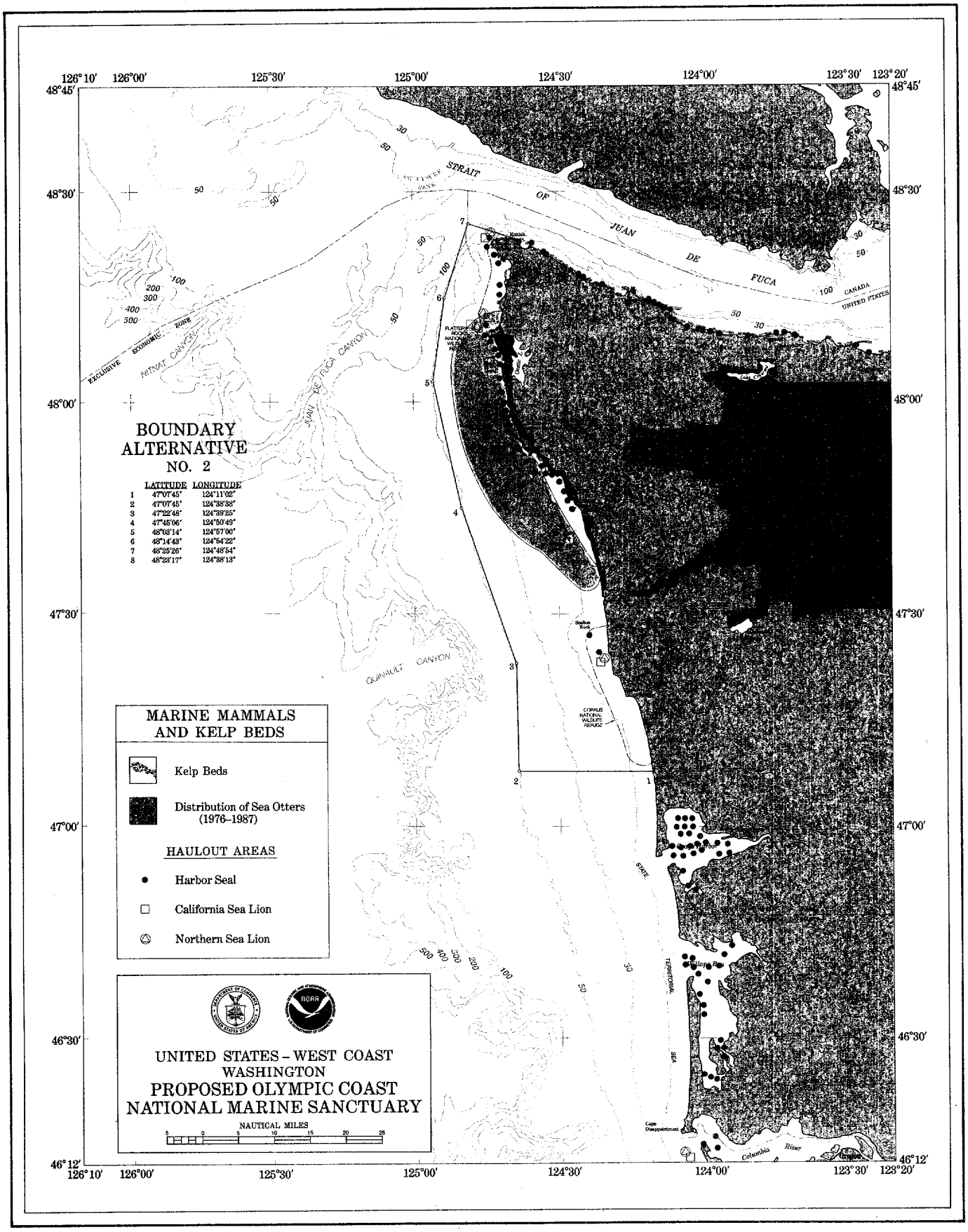


Figure 64. Boundary Alternative 2 with Respect to Marine Mammal Haulout Sites and Kelp Habitat.

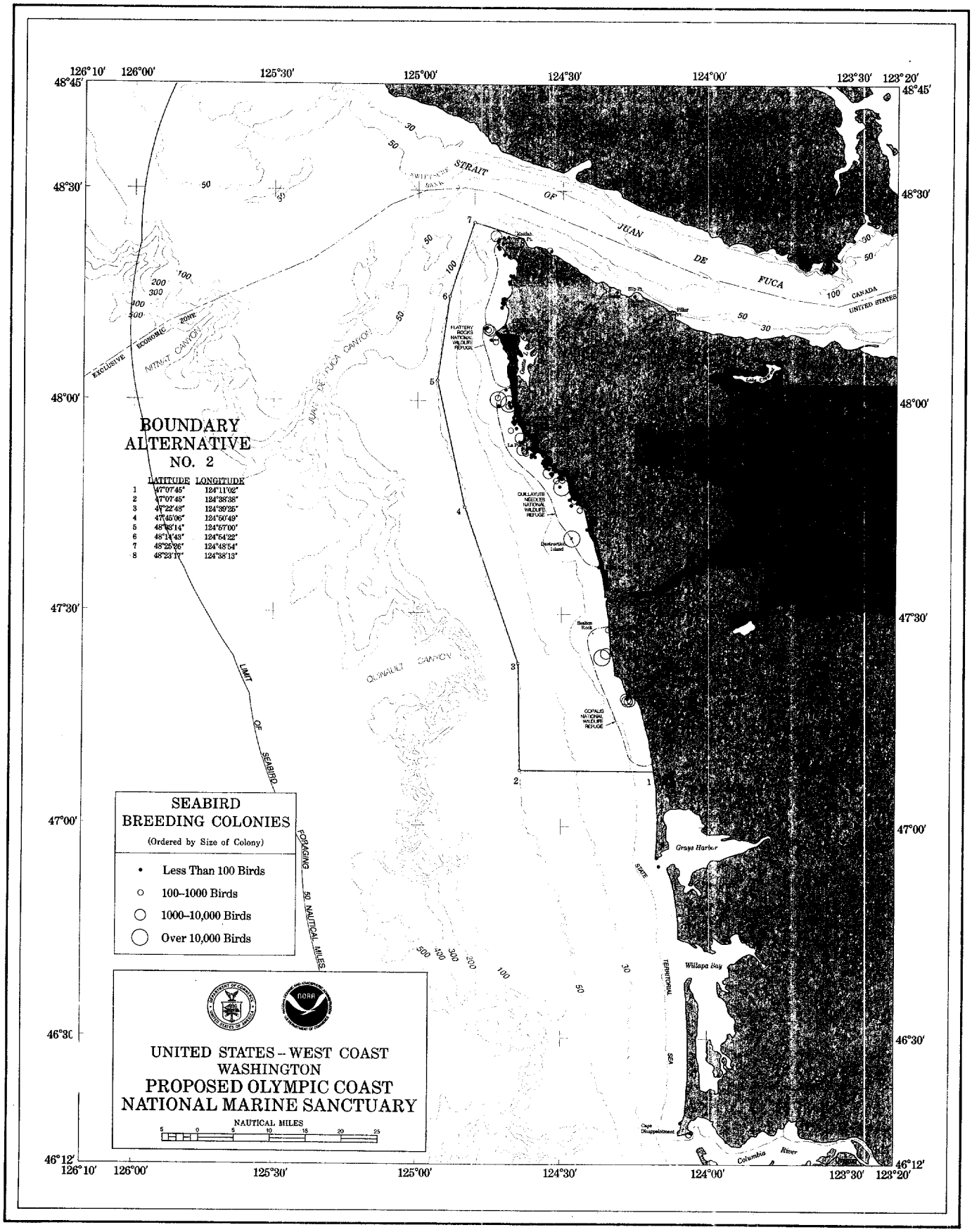


Figure 65. Boundary Alternative 2 with Respect to Seabird Colony Sites and Foraging Range.

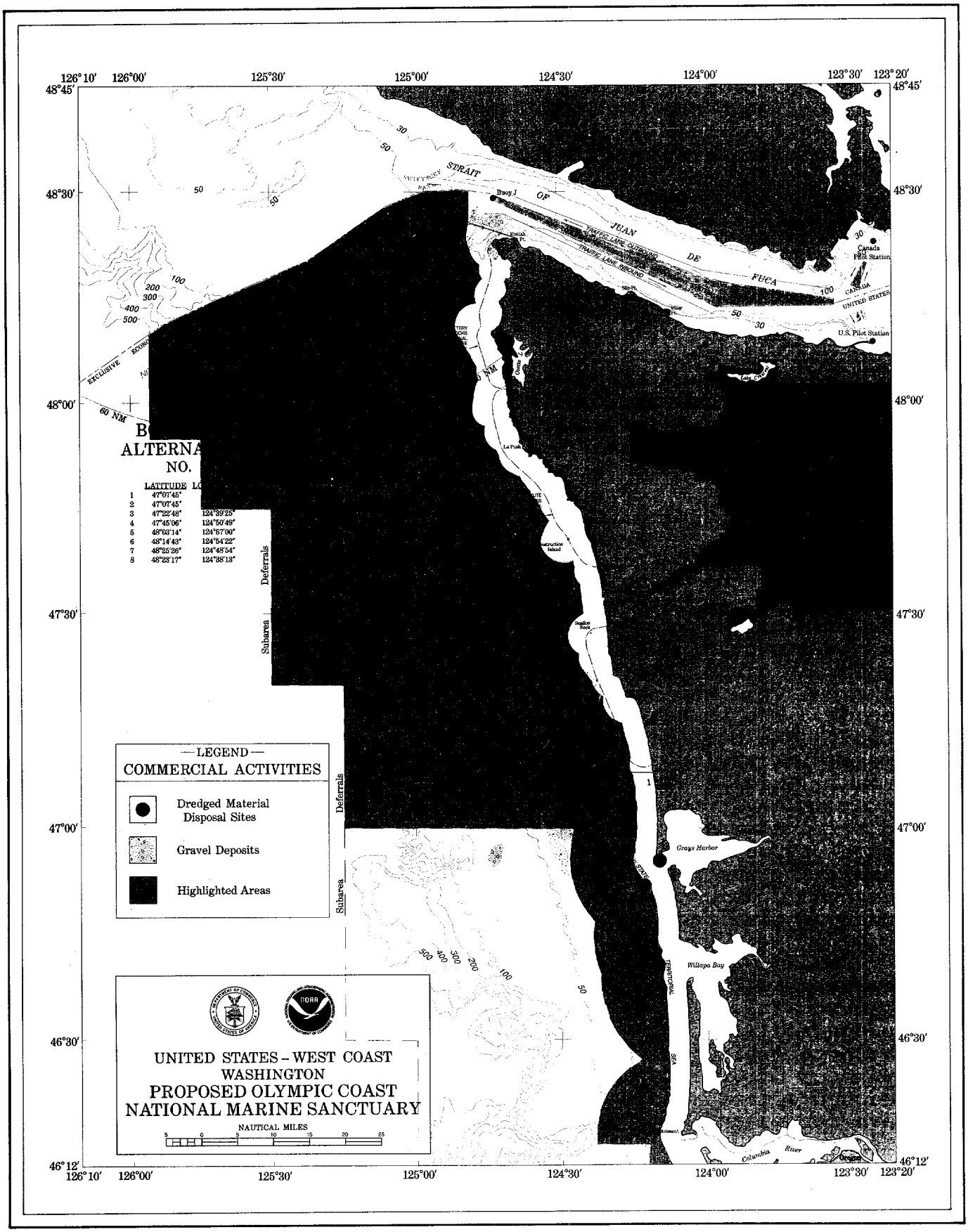


Figure 66. Boundary Alternative 2 in Relation to Vessel Traffic Management Regimes, Dredged Disposal Sites, Oil and Gas Resources and Gravel Deposits.

nearshore foraging areas. However, it still excludes those areas over the Juan de Fuca Canyon seaward from the entrance to the Strait of Juan de Fuca where one is most likely to see the densest concentrations of foraging seabirds. This area was recognized by the most recent and comprehensive seabird study of the West Coast, conducted by MMS, as one of the most significant seabird habitats off the west coast of the contiguous U.S.

From a human-use perspective, this boundary would encompass an increasing aerial extent of the former Lease Sale #132 which adds a greater buffer from impacts of coastal development. This will protect the viewshed off the Sanctuary by maintaining its pristine quality. This boundary alternative also encompasses more of the vessel traffic corridor. Radar coverage from Tofino extends 15 miles into this boundary alternative. Figures 67-70 depict boundary alternative 3 with respect to the areal extent of fisheries, marine mammal haul out sites, kelp distribution, and human uses other than fishing.

E. Boundary Alternative 4

Boundary alternative 4 was the preferred boundary in the DEIS/MP for the Olympic Coast National Marine Sanctuary. Pursuant to comments on the DEIS/MP, NOAA has undertaken an analysis of the resources, uses, and coastal development patterns in the Strait of Juan de Fuca. Boundary alternative 4, as it appeared in the DEIS/MP, includes the area of boundary alternative 3 and the addition of the head of the Juan de Fuca Canyon. The boundary includes the key fishing areas off the Strait, the most significant bird foraging areas, additional ocean pink shrimp, squid, salmon, and groundfish harvesting areas. This is also the area where vessels converge as they enter and exit the Strait of Juan de Fuca. It is a complex area in terms of managing human uses due to the variety of uses, vessel types, cargo and languages spoken by mariners. This complexity was most recently evidenced by the sinking of the Tenyo Maru which resulted in an oil slick along the coast killing numerous pinnipeds, birds and fish.

NOAA's analysis of the resources and uses in the Strait demonstrate that the Strait is ecologically contiguous with the outer coast environment. The Strait of Juan de Fuca is widely recognized as a transition zone between the open ocean characteristics of the outer Washington Coast and the inner sea dynamics of Puget Sound proper. These characteristics include beach profiles, sediment types, bathymetry, salinity, currents, wave force, and biological resources. No study has been identified that specifically defines a boundary between the outer coast ecosystem and that of the inner sea. In any event, such a boundary would hardly exist in nature as a fixed line of demarkation but rather a band or zone where open ocean processes cease to predominate and inner sea processes (hereafter referred

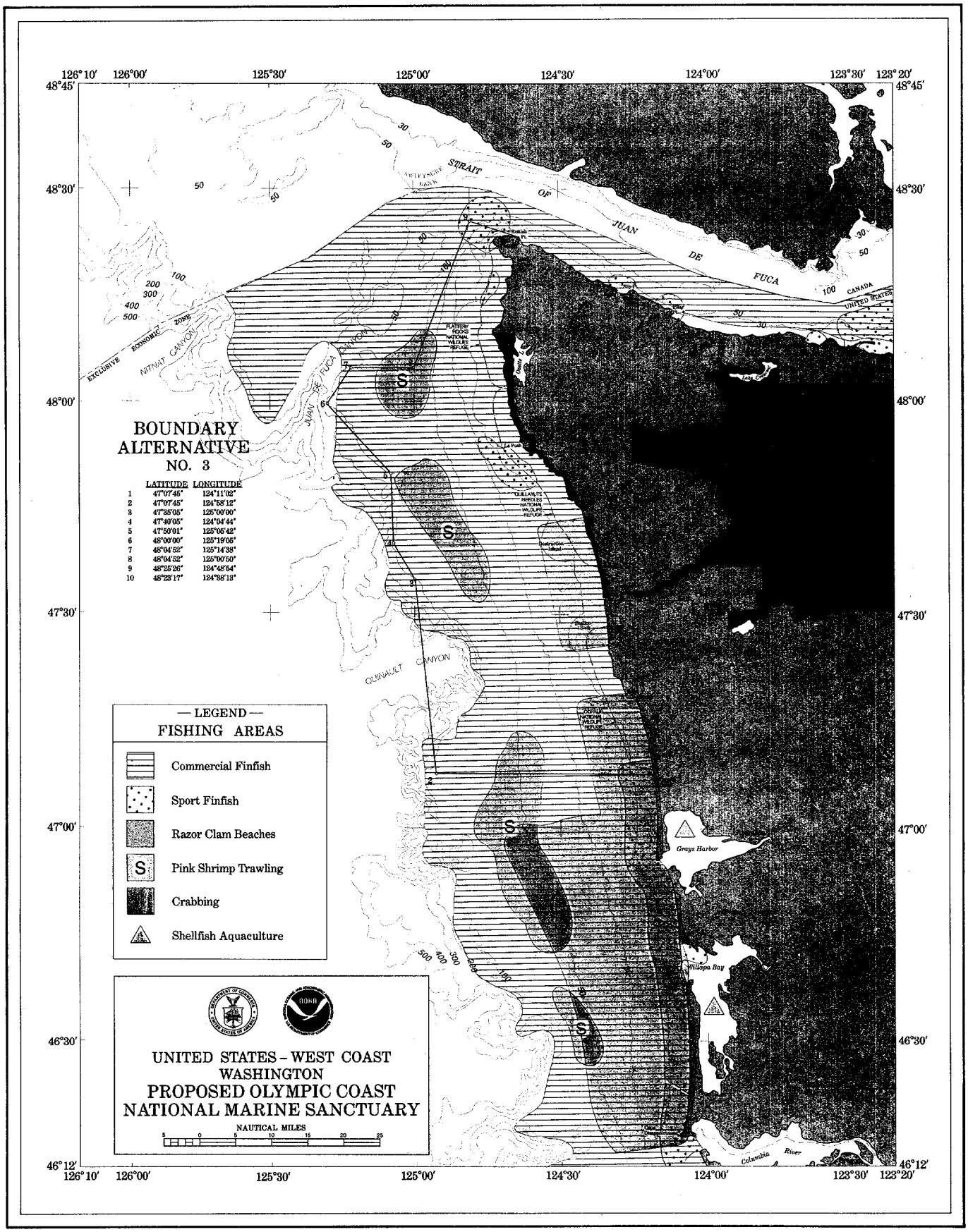


Figure 67. Boundary Alternative 3 with Respect to Fisheries.

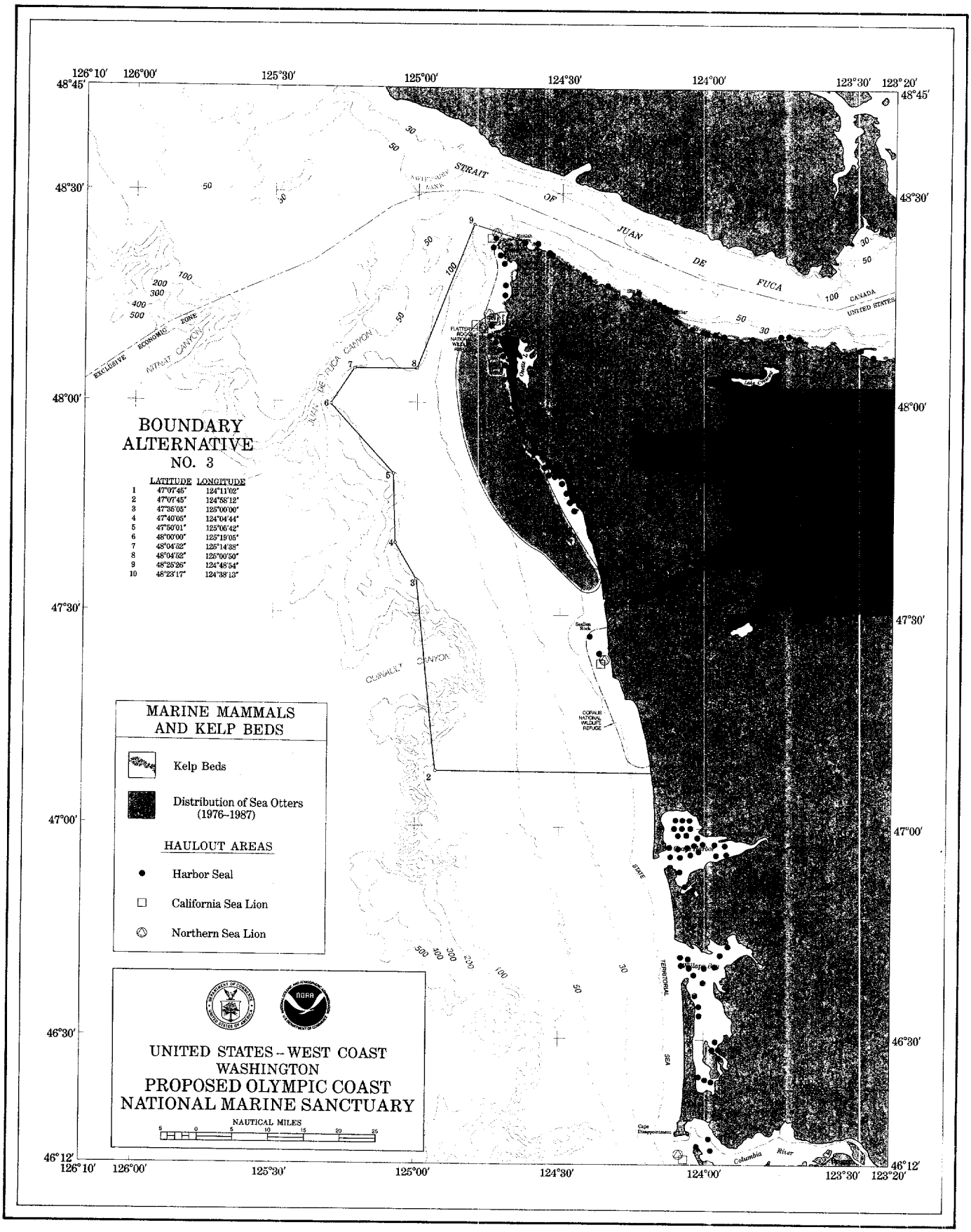


Figure 68. Boundary Alternative 3 with Respect to Marine Mammal Haulout Sites and Kelp Habitat.

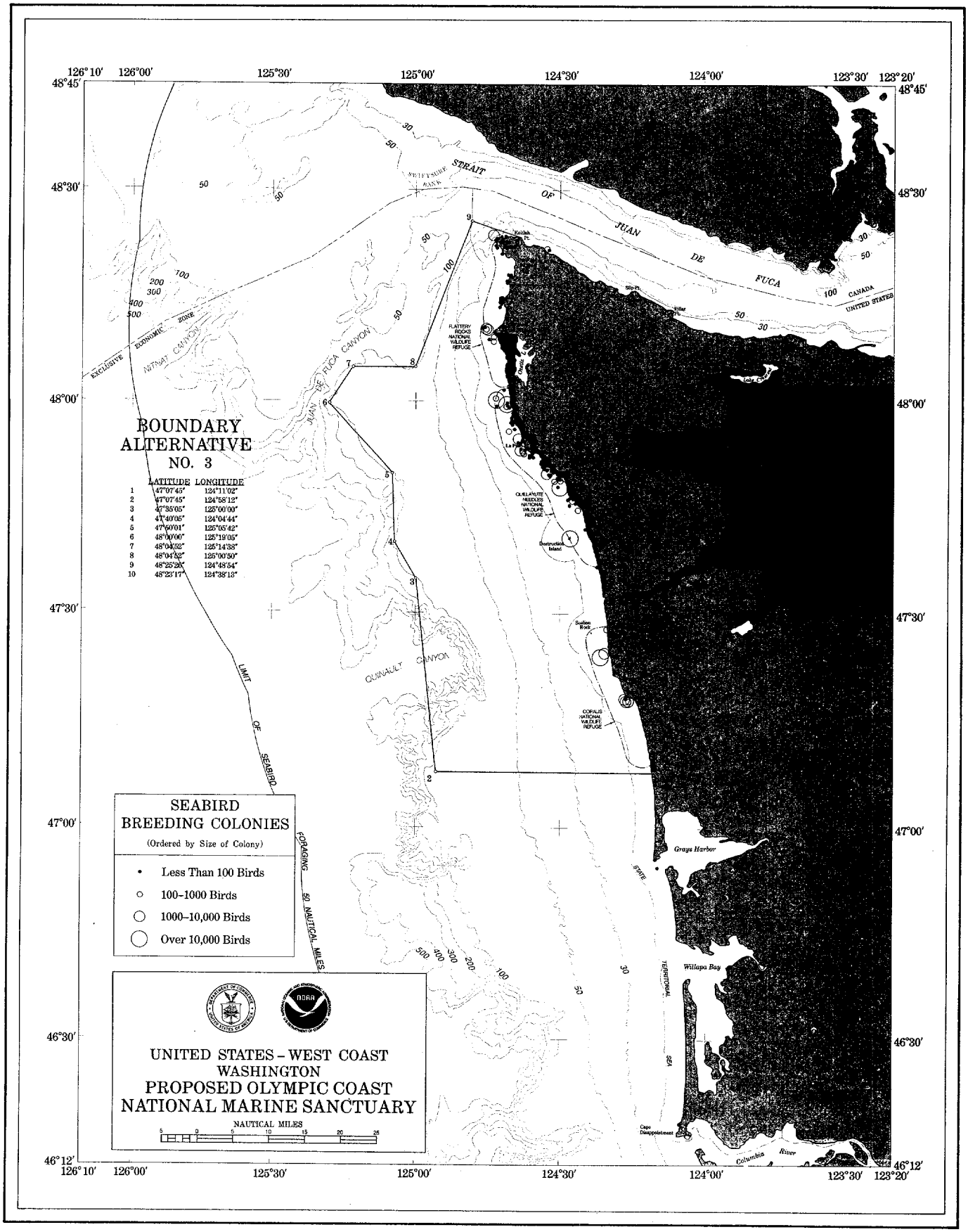


Figure 69. Boundary Alternative 3 with Respect to Seabird Colonies and Seabird Foraging Range.

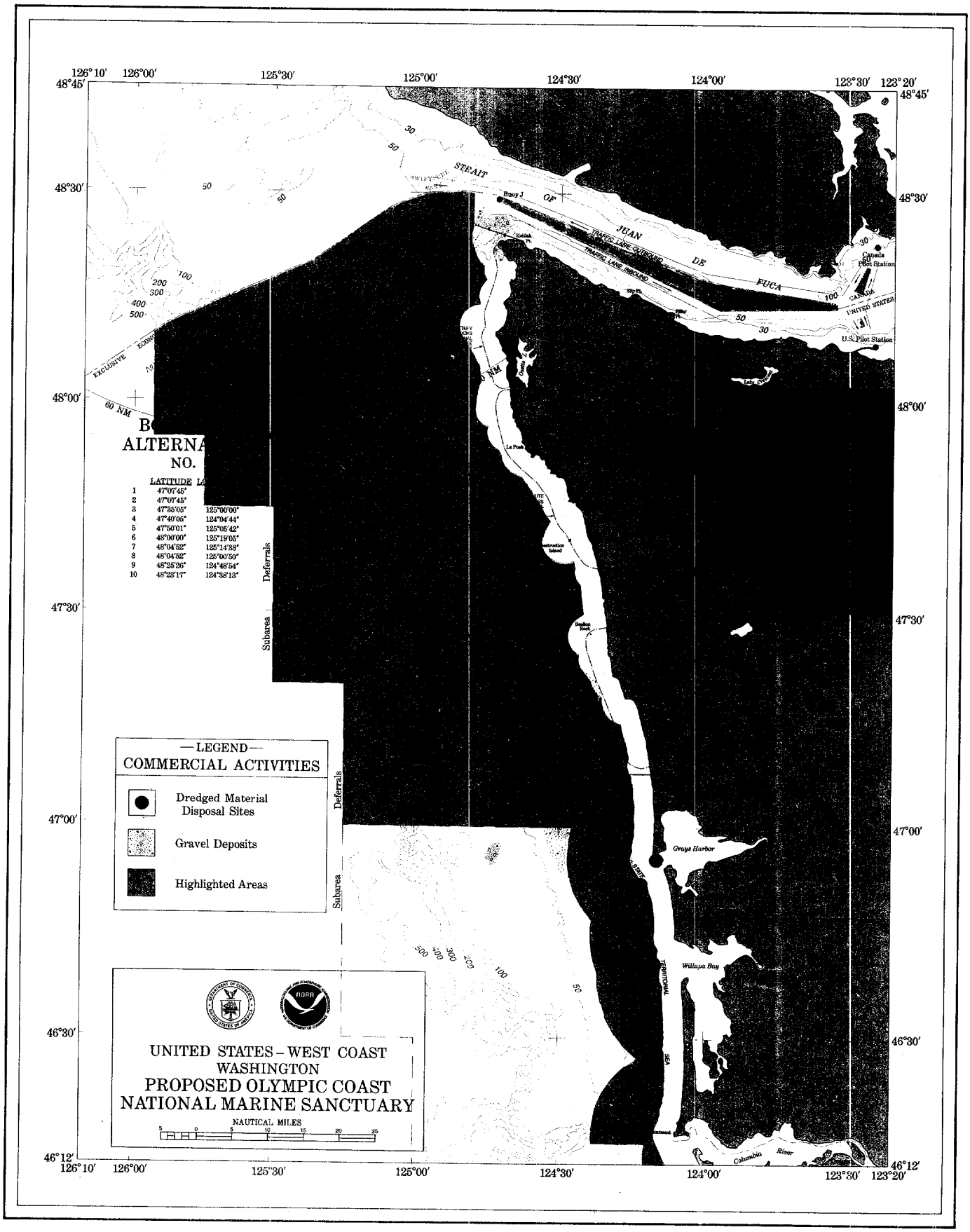


Figure 70. Boundary Alternative 3 in Relation to Vessel Traffic Management Regimes, Dredge Disposal Sites, Oil and Gas Resources and Gravel Deposits.

to as "estuarine") become more common. Once such a zone is identified, a fixed boundary may be drawn that will include the furthest inland approach of oceanic processes in any given season.

The entire Strait of Juan de Fuca east to the San Juan Islands is decidedly marine in character with water salinity approaching that of the Pacific Ocean (29 to 21 ppt). Salinity is often lowest

in the eastern and northern portions of the Strait due to the influence of the Fraser River and other freshwater sources. Surface temperatures range between 8° C and 11° C; the west portion of the Strait of Juan de Fuca is warmest due to the influence of Pacific Ocean Water" (Long, 1983). The water column in the San Juan Island area is more stratified due to a large volume of freshwater inflow from the Fraser River. Water density in the Strait of Juan de Fuca is fairly homogeneous at all depths. The salinity and temperature regime of the Strait does not shift or change in any manner that would distinguish oceanic from estuarine processes (Duxberry, p.c., 1992).

The center channel of the Strait exceeds 100 fathoms from the western entrance to the head of the Juan de Fuca subsea canyon (offshore of the Twin River estuary). The westward limit of the Juan de Fuca Canyon extends several miles off the Washington coast. Though upwelled water travels up the canyon, upwelling occurs across the width of the Strait. However, the distribution and density of upwelled nutrients in the Strait has not been systematically identified (Duxbery, p.c., 1992).

Studies in the late 1970's conclude "that year-round net circulation in the Strait consists of a rigorous two-layer estuarine [current] pattern with seaward flowing near-surface currents of 20-40 cm/S and landward flowing deeper currents of -10 cm/S. The level of no net motion is typically between 40 and 60 m. These studies also have shown that during non-summer months, the near surface (upper 15 m) circulation in the western Strait is dominated by the sub-tidal motions with periods of 5-30 days which induce reversals in the estuarine flow of up to 60 cm/S. Such sub-tidal fluctuations are strongly correlated with local winds, atmospheric pressure, and sea level. During a later winter experiment in the eastern strait, seven such current reversals lasting from 2-6 days with maximum upstrait velocities of 20 cm/s were found to depend upon the direction, strength, and duration of winds associated with coastal cyclonic storms. During current reversals, coastal water, which can be fresher owing to Columbia River discharge and warmer owing to summer heating, has been observed to intrude up to 135 km into the strait (vicinity of Dungeness Spit)" (Frisch et al., 1981). Studies have "also found evidence for the reversals to intrude along the southern half of the western strait first...Details of

the flow at the interface between inflow and outflow were mapped with an HF current-mapping radar and reveal complex mixing circulation with diversion to the south" (Frisch et al., 1981). This area of mixing is located between Victoria BC, Dungeness Spit and Port Angeles. In addition to these surface and deep-water current flows, longshore flows between Cape Flattery and Dungeness Spit are not appreciable for the most part, but when existing (usually in pocket beach areas) flow in an easterly direction (Schwartz, 1991).

The coastline west of the Elwha delta is composed predominately of bedrock. It is characterized by rocky exposed shorelines and intertidal areas, small estuaries, short pocket beaches, and high steep backshores. The armored shoreline is stable with a minimum of longshore sediment transport (net shore-drift). The coastline east of the Elwha Delta is primarily composed of eroded and compacted glacial till. It is characterized by sand spits, protected bays, gradually sloped beaches and mudflats (Shipman, 1992).

The geological break at the Elwha Delta between western and eastern features of the Strait coincides with biological distinctions in the same area. West of the Elwha River delta are the most proliferous macrocystis kelp beds in the state (located near the Twin River delta). Macrocystis is described as "strictly an open coast species" (Kyte, 1992) and extends into the Strait eastward to Crescent Rock where it abruptly ends.

The macrocystis beds are accompanied by other organisms endemic to the outer coast. Three species of oceanic sea anemone are found inland to Tongue Point. These are Urticina Lofotensis (White Spotted Tillia), Urticina Piscivora (Fish Eating Tillia), and Anthopleura Xanthogrammica (giant green anemone). Giant green anemone range eastward beyond Tongue Point but only to Observatory Point where their concentrations end. Though some are found sporadically in the San Juan Islands, no significant populations exist east of Observatory Point (Kyte, 1992).

The Purple Urchin (Strongiocentrotus Purpuratus) is a grazer that moves among the rocks in search of kelp. Purple Urchin populations do not extend east of Tongue Point except for scattered numbers in the San Juan Islands.

Two common oceanic invertebrates, California Mussels (Mytilus Californianus) and Gooseneck Barnacles (Pollicipes Polymerus), also share the exposed rocky habitat of the north Olympic Peninsula. These species are commonly found on the outer Washington coast. A cursory survey from the Elwha River to Slip Point identified mixed populations of these species between Observatory Point and Tongue Point in the east and between Pillar Point and Slip Point to the west (Goodwin, 1992). Both species form dense beds in the intertidal zone where wave action is

strong. Gooseneck Barnacles are only found on vertical to near-vertical surfaces. Giant green anemones settle into these colonies during their early life stages. As the anemones mature, they move into the lower intertidal and subtidal zones where wave action makes prey available to this passive predator. Giant green anemones may live from 50 to 100 years and grow up to a foot in circumference. Also associated with the mussels and barnacles is the Purple or Ocher Sea Star (Pisaster Ochraceus), a predator to both species.

An important element to any ecosystem is the relationships between the organisms found there. The organisms listed above interact with each other to form one example of biological interdependence along the shores of the Strait of Juan de Fuca. The rocky substrate and strong wave action from the Pacific Ocean create the conditions necessary for the proliferation of the California mussels and gooseneck barnacles. These residents feed on plankton that is washed in by the surf. Another resident, the purple urchin, grazes on the nearby kelp. As the mussels and barnacles colonize into dense beds, the green anemone moves in and waits for urchins and other organisms to be scoured from the rocks by strong waves and delivered into it's tentacles. This set of interactions has been documented by Dr. Robert Paine (Professor of Zoology at the University of Washington). Though some of the species involved may be found individually in areas of the San Juan Islands, these species are never found together as a functioning community east of Observatory Point. Since the community is common to the outer coastal regions of the Pacific Northwest, its presence in the Strait provides an indicator that the coastal ecosystem extends into the Strait as far east as Observatory Point.

Macrocystis, as an individual species, is decidedly an open coast oriented kelp. The fact that rocky habitat extends east of Crescent Rock - Macrocystis does not - indicates that factors beyond mere topography are necessary for its survival beyond that point. Since Macrocystis thrives on the coast, some significant property of the coastal environment must end at Crescent Rock. This indicates a break between the oceanic processes of the outer coast and the estuarine processes of inner Puget Sound. It should be noted that Crescent Rock is within six miles of the point where the community in the previous paragraph ceases to function. Macrocystis also serves as a food source for sea urchin which in turn serve as prey for sea otters (Enhydra Lutris) . Macrocystis beds are a common habitat feature where sea otters are present.

Sea otters have been identified inside the strait as far as First Beach on the eastern side of Neah Bay. "The sea otter is on the list of Washington State Endangered Species. The federal government considers the California sea otter a threatened species, but not the Alaskan sea otter (the source stock of sea

otters in Washington)" (Calambokidis et al., 1987). The Strait contains the greatest percentage of Washington shoreline occupied by kelp (Thom and Hallum, 1990). As the Washington Coast sea otter population expands, it is expected that otters will move into these prime habitat areas of the strait (Strickland and Chasan, 1989).

The Strait of Juan de Fuca serves as a transit and migration corridor for marine birds, mammals and ocean organisms entering from the outer coast. Up to 300,000 common murres may enter northern Puget Sound in any given year during the molting season. Since the birds are mostly flightless, they must use the Strait to access the inland waterways (Strickland and Chasan, 1989). Drift studies have identified oceanic species in significant quantities as far east as Dungeness Spit. Curt Ebbesmeyer has been studying currents and drift patterns in the Strait for 15 years and estimates that 1 of every 1000 organisms on the Washington Coast enters the Strait of Juan de Fuca on eastward current flows and migrates along the north shore of the Olympic Peninsula. Such transfers of outer coast resources are indicative of an inland extension of the coastal ecosystem. (Note: The 1/1000 transfer capacity of the currents is also Ebbesmeyer's estimate for the rate at which oil spilled at the Strait entrance would travel inland.)

There is evidence that up to 15 gray whales spend the summer near Cape Flattery. Gray whales have often been sighted well inside the Strait of Juan de Fuca. "Unlike most cetaceans, gray whales feed on bottom animals; in Northwest waters, these prey include amphipod and mysid crustaceans near kelp beds" (Strickland and Chasan, 1989). A 1985-86 survey of gray whale presence between Cape Flattery and Pillar Point tracked a continuous presence of the species from December through the summer. Gray whales were often seen foraging in kelp beds between Koitlah Point and the Sekiu River (Calambokidis et al., 1987).

In the above survey conducted between Cape Flattery and Pillar Point, "two species of small cetaceans were frequently seen...Harbor porpoise were the most abundant cetacean and were seen primarily from 0.5 to 1.5 nm offshore. Sighting frequency of harbor porpoise varied by region with the greatest numbers seen off the Sekiu River and Kyadaka Point. Harbor Porpoise were present in all seasons but were most numerous in fall. Dall's porpoise were seen less often than Harbor Porpoise and tended to occur farther offshore. Dall's porpoise were seen in all seasons" (Calambokidis et al., 1987). A report prepared for the National Marine Mammal Laboratory in April, 1992 estimates harbor porpoise abundance for the Strait of Juan de Fuca and Swiftsure Bank at 2,226 animals. It is the first comprehensive report of harbor porpoise in the Strait. The report also listed direct sightings of 100 Dall's porpoise in the same area (Calambokidis

et al., 1992).

California sea lions are present in the Strait and appear in a small concentration at Neah Bay. Harbor seals are the most common marine mammal in the Strait and have many haul-out sites between Cape Flattery and Observatory Point (Calambokidis et al., 1987). Migrations have been observed from the outer coast and eastern Strait of Juan de Fuca into the western Strait (Strickland and Chasan, 1989).

The majority of strictly pelagic birds (e.g., albatrosses, cassin's auklets, shearwaters, storm petrels), however, do not enter and reside inside the Strait for any appreciable length of time or in large numbers. Most only appear at Tatoosh Island and seaward. Swiftsure Bank, at the entrance of the Strait, is a critical feeding area for birds (Wahl, 1992). "Huge feeding flocks estimated to approach one million birds (have been) observed at the entrance to the Strait of Juan de Fuca" where oceanic fronts converge (Strickland and Chasan, 1989). It should be noted however that no comprehensive bird studies have been conducted exclusively for the Strait of Juan de Fuca. Nor has any research been conducted to analyze bird populations within the Strait in the context of ecosystem dynamics.

This analysis suggests that the ecosystem of the outer Washington coast extends into the Strait of Juan de Fuca as far eastward as Observatory Point. Changes in biota, geology, and topography all appear to coalesce between Crescent Rock and Observatory Point. The constant eastward drift and migration of coastal organic matter resupplies the area with new colonists and prey organisms. Coastal water is transported into the Strait by currents that break and mix north of Dungeness Spit. The dense kelp beds are a central factor to the productivity in the Straits and Macrocystis serves as a particularly strong indicator for the inland extent of the coastal environment.

The human uses in the Strait include vessel traffic, commercial, recreational and tribal fishing, recreational boating and SCUBA Diving. The Strait is a heavily used corridor for barges, larger commercial vessels and fishing boats transiting between the outer coast and Puget Sound. There is a carefully coordinated vessel traffic system operated jointly by the U.S and Canadian Coast Guards to manage vessel traffic (see Part II for further discussion). Clallam Bay and Neah Bay are central locations for the charter boat industry and recreational fishing in the Strait is concentrated off Pillar Point, Slip Point and Neah Bay. Although various types of clams are present throughout the Strait, recreational clam digging in the Strait is prohibited from April 1 through October 31 due to Paralytic Shellfish Poisoning. The Strait is a Usual and Accustomed fishing area for some of the Tribes. Gillnets are used by Tribal fishers in the Strait to harvest salmon.

The kelp beds, subtidal communities, and a shipwreck off Tongue Point offer spectacular diving throughout the Strait. Most of the beaches (i.e., tidelands) in the Strait are publicly owned (Figure 71). Access to these beaches is severely restricted because the back beach environment is characterized by steep bluffs in private ownership to the extent of high tide. There are approximately seven access points along the entire Strait between Observatory Point and Neah Bay. Most of the beaches are accessible only by boat, and then under mostly dangerous conditions because of submerged rocks and strong tidal currents. The beaches are predominately sand, gravel, cobble and hardpan and submerged at mean high water. Boat access ramps are limited to Freshwater Bay, Silver King Resort and Pillar Point Recreation Area.

Clallam County has developed county parks at Observatory Pt. (Freshwater Bay Recreation Area) and Tongue Pt. (Salt Creek Recreation Area) which provide boat access ramps, shoreside access for SCUBA Divers, sport fishing, picnic tables and other outdoor recreation. The WDNR has developed a state park at the Lyre River with many of the same accommodations. The Twin River and Pyscht River have undeveloped recreation areas. Clallam Bay has a harbor supporting a popular charter boat industry.

Coastal land ownership patterns in the Strait adjacent to the beaches include reservation lands (the Makah Tribe), private landowners (including timber companies), and county and state protected lands. The towns of Joyce, Clallam Bay, Sekiu, and Neah Bay are the population centers along the Strait. Their economies are influenced by recreational and commercial activities occurring in the Strait of Juan de Fuca.

Boundary alternative 4 with a southern boundary extending to Copalis Beach, and eastward into the Strait to Observatory Point encompasses what can be considered a distinct ecological system with intertidal communities, rookeries and haul out sites, foraging areas, rich fishing grounds and fish concentrations, and proliferous kelp beds continuous throughout this boundary. Vessel traffic, oil and gas exploration, fishing, minerals mining, and overflights, are all uses that can potentially threaten the resources of this still relatively pristine area.

An extension into the Strait to Observatory Point would afford maximum protection and monitoring of the coastal resources within an identifiable ecological system. The Strait is where much of the population and uses are concentrated. Protection and monitoring of the resources would be beneficial. Further, coordination of Sanctuary research and education programs would enhance the efforts of the State, local and tribal initiatives in the Strait. When further opportunity is provided for public comment NOAA will re-consider adding the Strait into the boundaries of the Olympic Coast or the proposed Northwest Straits

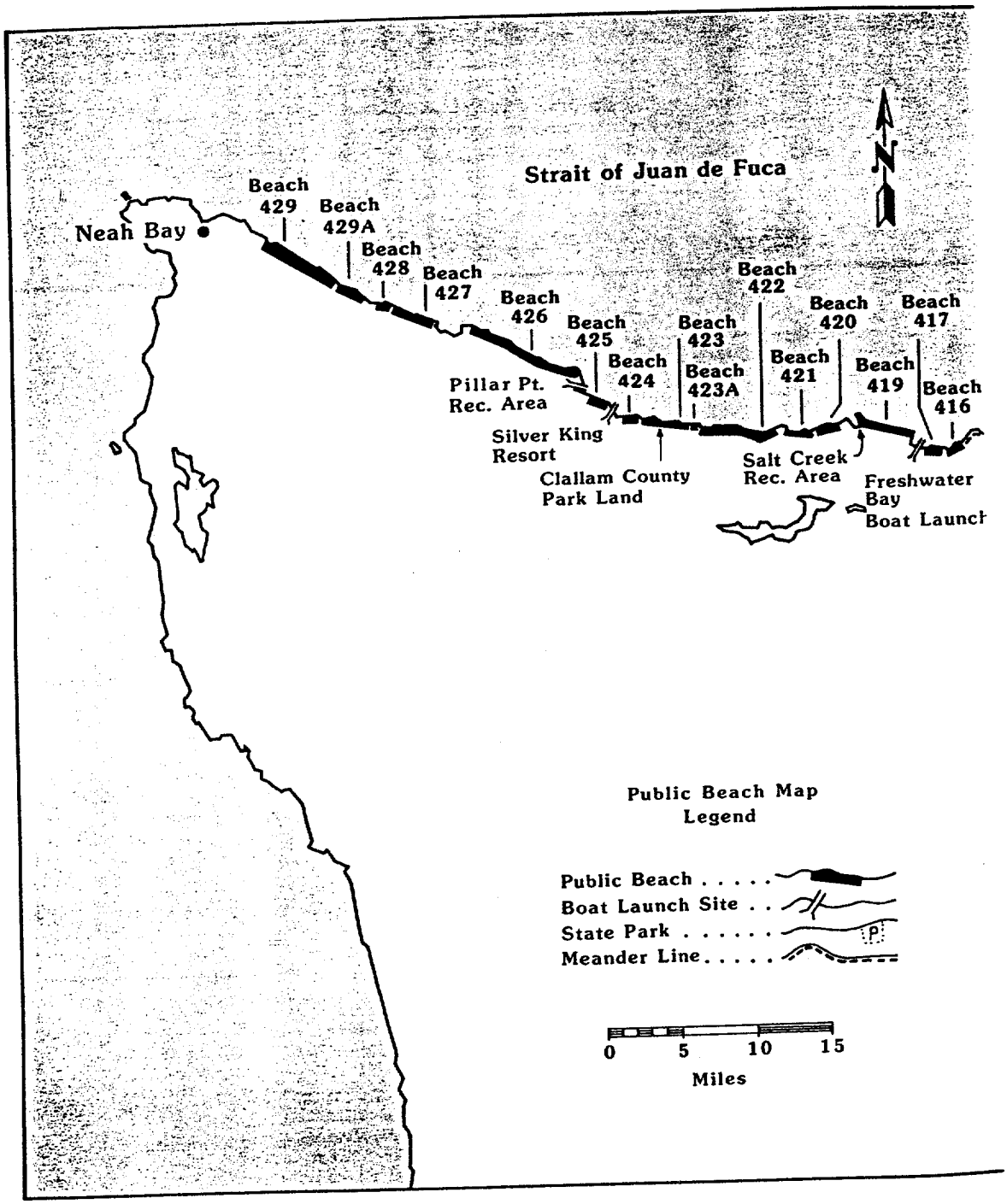


Figure 71. Beaches Along the Strait of Juan de Fuca (WDNR, 1984).

Marine Sanctuaries.

Boundary alternative 4 excluding the Strait, therefore, is NOAA's preferred alternative. The boundary encompasses the most sensitive and vulnerable habitats along the outer coast and, although excludes the transition corridor into the estuarine environment of Puget Sound, includes an ecologically identifiable oceanic ecosystem. The boundary will facilitate close coordination with Tribal, Federal, International, State and local initiatives. Through this coordination, the Sanctuary will afford greater protection to the nearly pristine environment off the Outer Coast. Boundary alternative 4 with Respect to the fisheries, marine mammal haul out sites, kelp distribution, seabird colonies and foraging range, and human uses other than fisheries are depicted in Figures 72-75.

F. Boundary Alternative 5

Boundary alternative 5 encompasses the entire study area from the Washington/Oregon Border to the Canadian Border and into the Strait of Juan de Fuca to Observatory Point. This alternative adds to boundary alternative 4 the sandy beach environments of the southern coast. Many commenters supported inclusion of the estuaries of Grays Harbor and Willapa Bay within the boundaries. However, upon further consideration, NOAA believes that the estuary of Grays Harbor and Willapa Bay are more appropriate candidates for estuarine management regimes such as NOAA's National Estuarine Research Reserve System (NERRS) or EPA's National Estuary Program (NEP) and thus the estuaries are not included in the Sanctuary study area of the Final EIS/MP. Therefore, the coastal boundary of alternative 5 cuts across the mouths of Grays Harbor and Willapa Bay.

Further, the southern portion of the study area abuts more populated areas and encompasses more marine development. The southern portion of the study area is clearly the most developed and populated regions of the Washington outer coast. Major population centers of Grays Harbor, Raymond, and Ocean Shores support fishing and logging industries, pulp and paper mills, port activities, and tourism.

Consequently, a large concentration of uses occur within the southern portion of the study area. This southern boundary encompasses valuable groundfish, salmon, ocean pink shrimp and dungeness crab fishing areas. It is also transited by tankers engaged in coastwise traffic, and tugs and barges entering and exiting the Ports of Grays Harbor, Willapa Bay, and the Columbia River. The tugs and barges transport, among other things, refined petroleum products, chemicals and logs and wood chips. There has been an ongoing $75 million Federal/State/local partnership to diversify the Port of Grays Harbor which has involved the dredging of Grays Harbor channel to enable larger

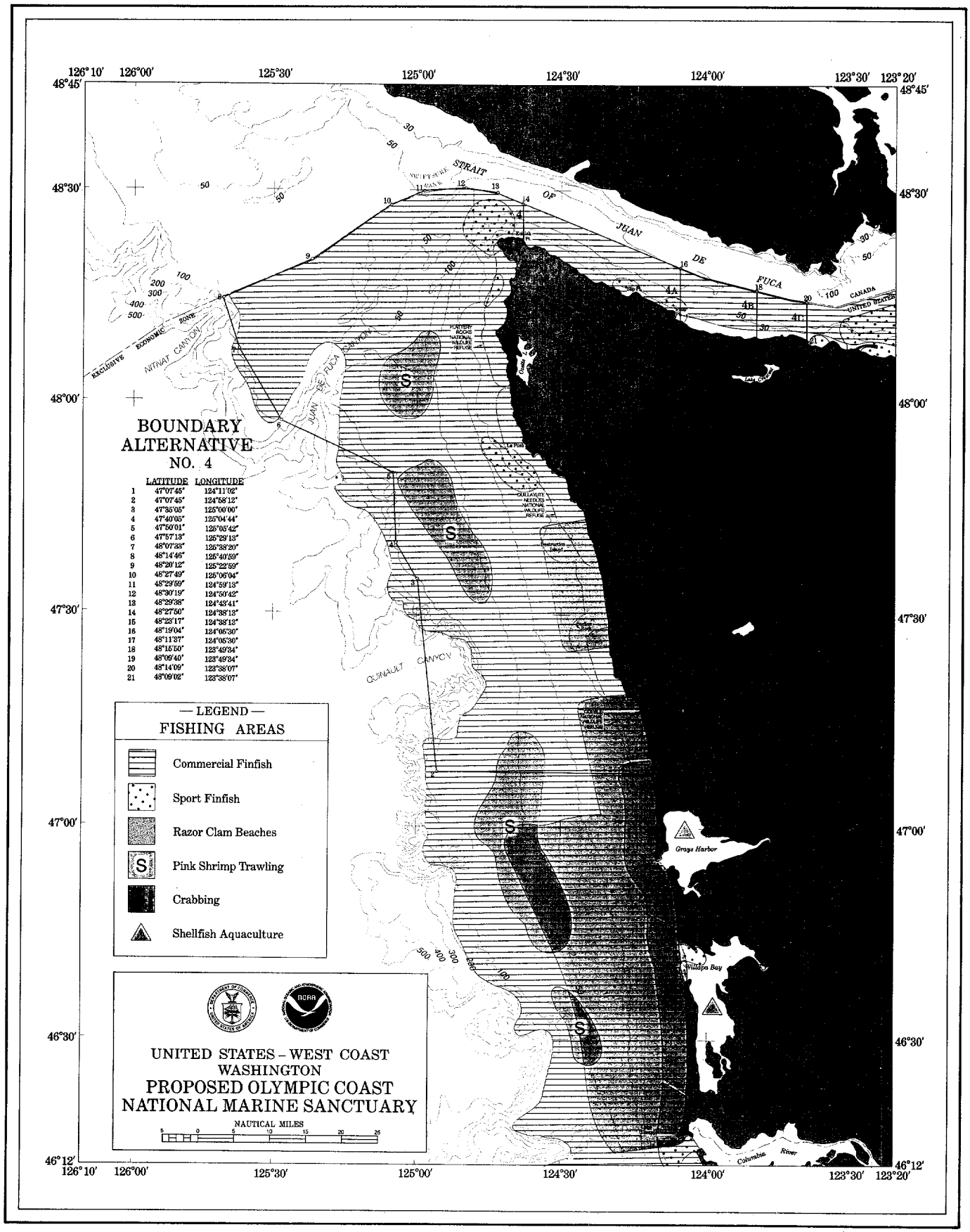


Figure 72. Boundary Alternative 4 with Respect to Fisheries.

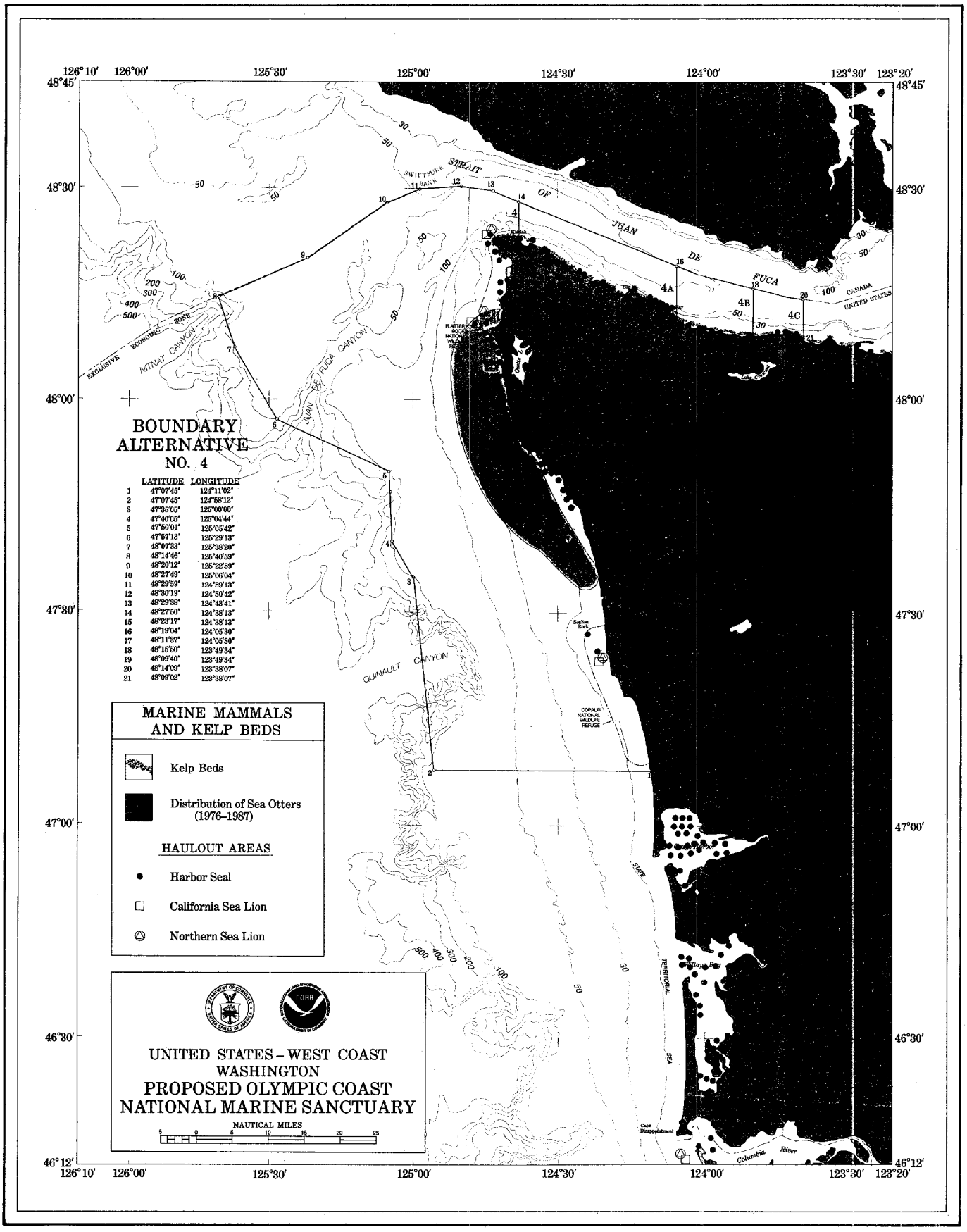


Figure 73. Boundary Alternative 4 with Respect to Marine Mammal Haulout Sites and Kelp Habitat.

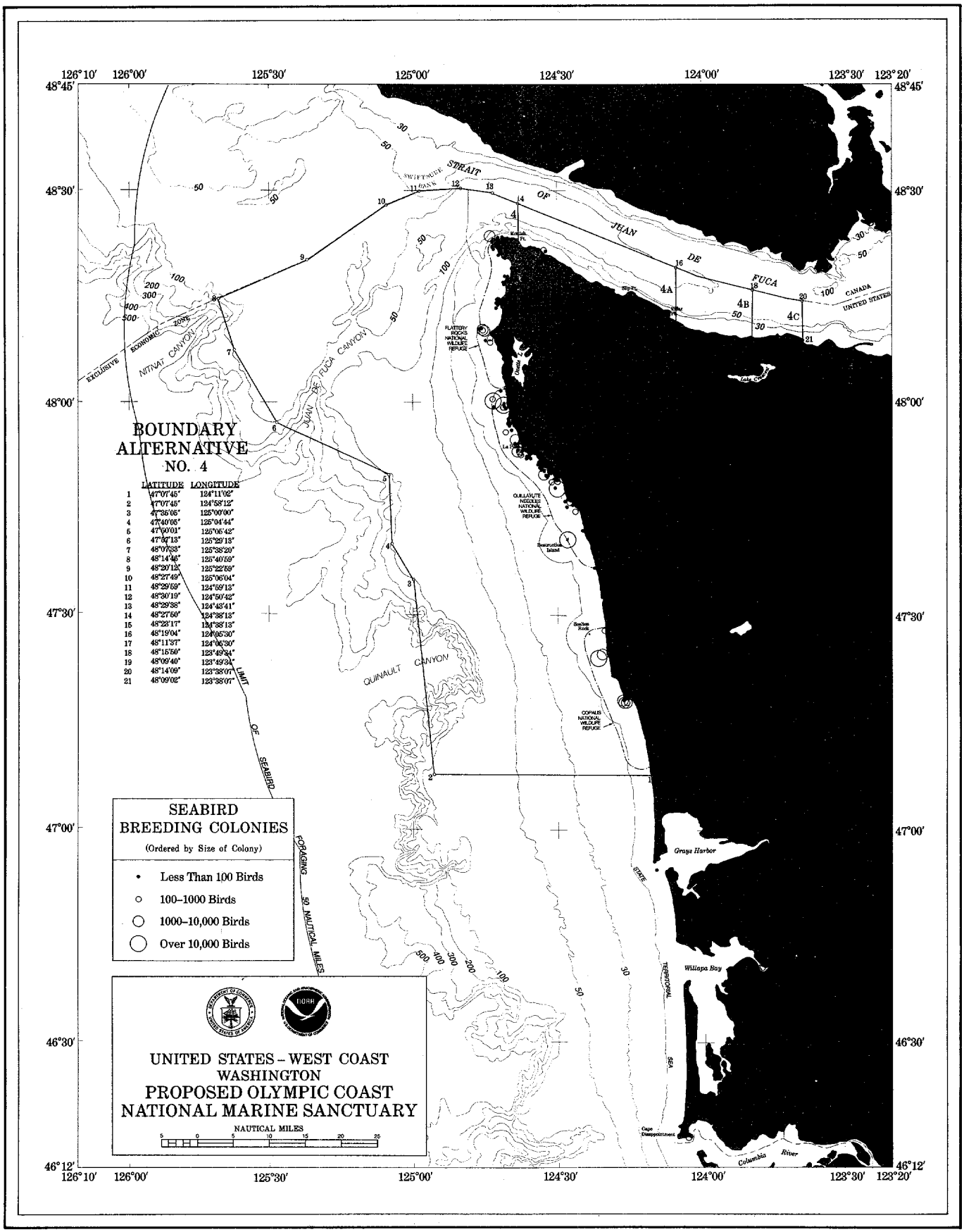


Figure 74. Boundary Alternative 4 with Respect to Seabird Colonies and Seabird Foraging Range.

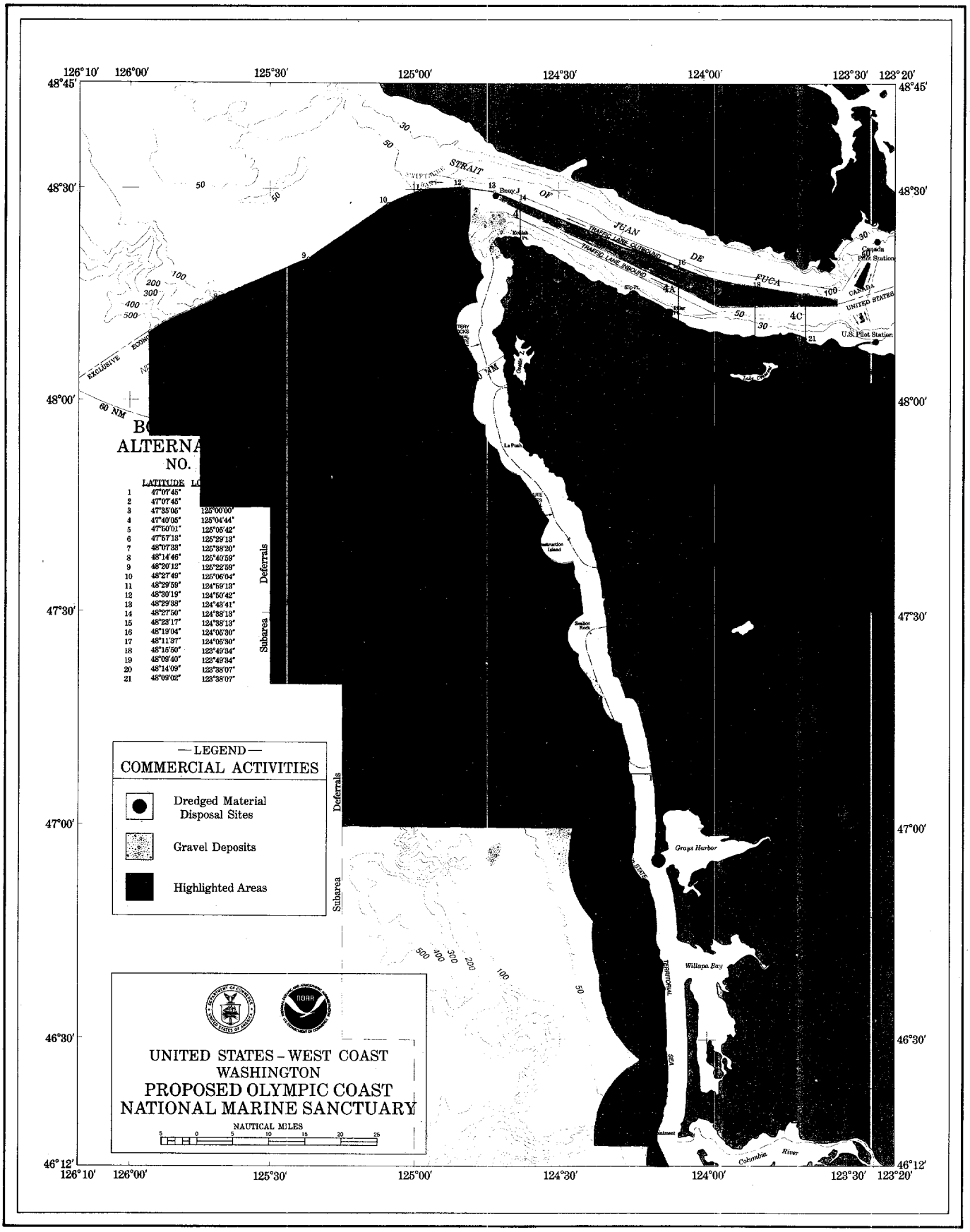


Figure 75. Boundary Alternative 4 in Relation to Vessel Traffic Management Regimes, Dredge Disposal Sites, Oil and Gas Resources and Gravel Deposits.

vessels to enter the port. Clean dredge spoil from the dredging project are dumped at three EPA/COE permitted dumpsites located off the mouth of Grays Harbor. There is also an interim dumpsite off the mouth of Willapa Bay and three others off the Columbia River all receiving dredge spoils from maintenance dredging of the respective ship channels. These dredge disposal sites and port activities would conflict with the Sanctuary regulations prohibiting alteration of, or construction on the seabed, and discharges.

The southern addition adds approximately 46% of the relative density of invertebrates harvested by commercial and recreational fishers in the total study area. The largest significance is attributed to the presence of Pacific oysters in Willapa Bay, and the Dungeness crab and ocean pink shrimp stocks offshore. This is reflected in the tables comparing the relative abundance and importance of selected invertebrates off Washington (Appendix C).

The southern addition also is significant in that it represents approximately 43% of the relative abundance of fish species in the study area. Salmon, steelhead, lingcod and Pacific cod account for the greatest density indexes. The salmon and steelhead accounted for in these areas are migrating through from the Columbia River, Chehalis, tributaries of Willapa Bay, as well as from river and stream systems located in Oregon. The significance of this addition is skewed by the importance of estuaries for marine fish. During the spring when freshwater inflow into the estuaries is greatest, and the predominant currents originate from the north, the Columbia River fresh water plume is kept south of Point Grenville dominating a large area of the marine environment off southern Washington. This essentially extends the Columbia River estuary well offshore. The boundaries of the water masses support rich fishing grounds.

The seaward portion of the southern addition is weighted as being very significant for marine mammals (Appendix C). This is due to the inclusion of the migration corridor for the right, minke, and humpback whales, Dall's porpoise and while-sided dolphins. The migration of these marine mammals are most heavily concentrated at the edge of the continental shelf. Gray whales migrate through the study area within approximately 12 nautical miles from shore. Appendix C reflects that the most seaward portions of the entire study area is significant for marine mammals. Hence, the extension of boundary alternative 5 adds little difference. The tables in Appendix C also reflect the significance of boundary alternative 5 because the estuaries are critical haulout sites for pinnipeds.

The table comparing the estimates of seabird populations within the study area indicates that only 12% of the population was counted in the southern boundary. The largest bird populations in the southern portion of the study are juvenile

rhinoceros auklets feeding off the mouth of Grays Harbor, Glaucous-winged gulls and caspian terns. Approximately four small colonies of pigeon guillemots are located in the jettys of Grays Harbor in driftwood debris at the opening of the Colombia River and Willapa Bay (Speich and Wahl, 1989). The estuaries provide valuable habitat for migrating shorebirds whose populations swell in the spring and fall.

While the resources in the southern portion of the study area are significant to the marine ecology of the Pacific Northwest, the analysis of resources and uses indicates that there are two separate but related ecosystems. To the north of Copalis Beach, the marine environment is dominated by rocky intertidal habitats, kelp forest subtidal habitats, and ecologically rich neretic zones all of which are fueled by upwelling from the Juan de Fuca Canyon coupled with the presence of the shallow offshore banks in the photic zone. This portion of the study area provides rich foraging areas and haul out sites for colonial seabirds and marine mammals. Sediments nourishing the benthic environment originate predominately from the Strait of Juan de Fuca. The coastal environment is sparsely populated, with the greatest immediate threats to the resources runoff from timber activities in the adjacent watersheds, and offshore development (vessel traffic, and potential offshore development of oil and gas and gravel deposits). The ability to respond to potential spills from offshore development are hampered by limited coastal access and the high energy marine environment.

By contrast, the sandy environments south of Copalis Beach are much less diverse (with the exception of the estuaries) and are capable of rebounding from an oil spill relatively quickly compared to communities of rocky intertidal habitats. The southern boundary has already experienced heavy development and there are a number of point and non-point source discharges and dumpsites. Consequently, the southern portion of the study area does not have the pristine qualities of the northern areas.

The benthic sediments in the southern portion of the study area originate from the Columbia River Basin reflecting the aerial extent and influence of the Columbia River Plume. The ecosystem that dominates the southern portion of the study area in fact extends well into Oregon and state boundaries present an arbitrary delineation. Thus, while there are significant ecological qualities to both the northern and southern regions of the study area, there are notable differences in their ecology and human-uses that characterize these regions as distinct. Figures 76-79 depict boundary alternative 5 with respect to fisheries, marine mammal haul out sites, kelp distribution, seabird colonies and foraging range, and human uses other than fishing.

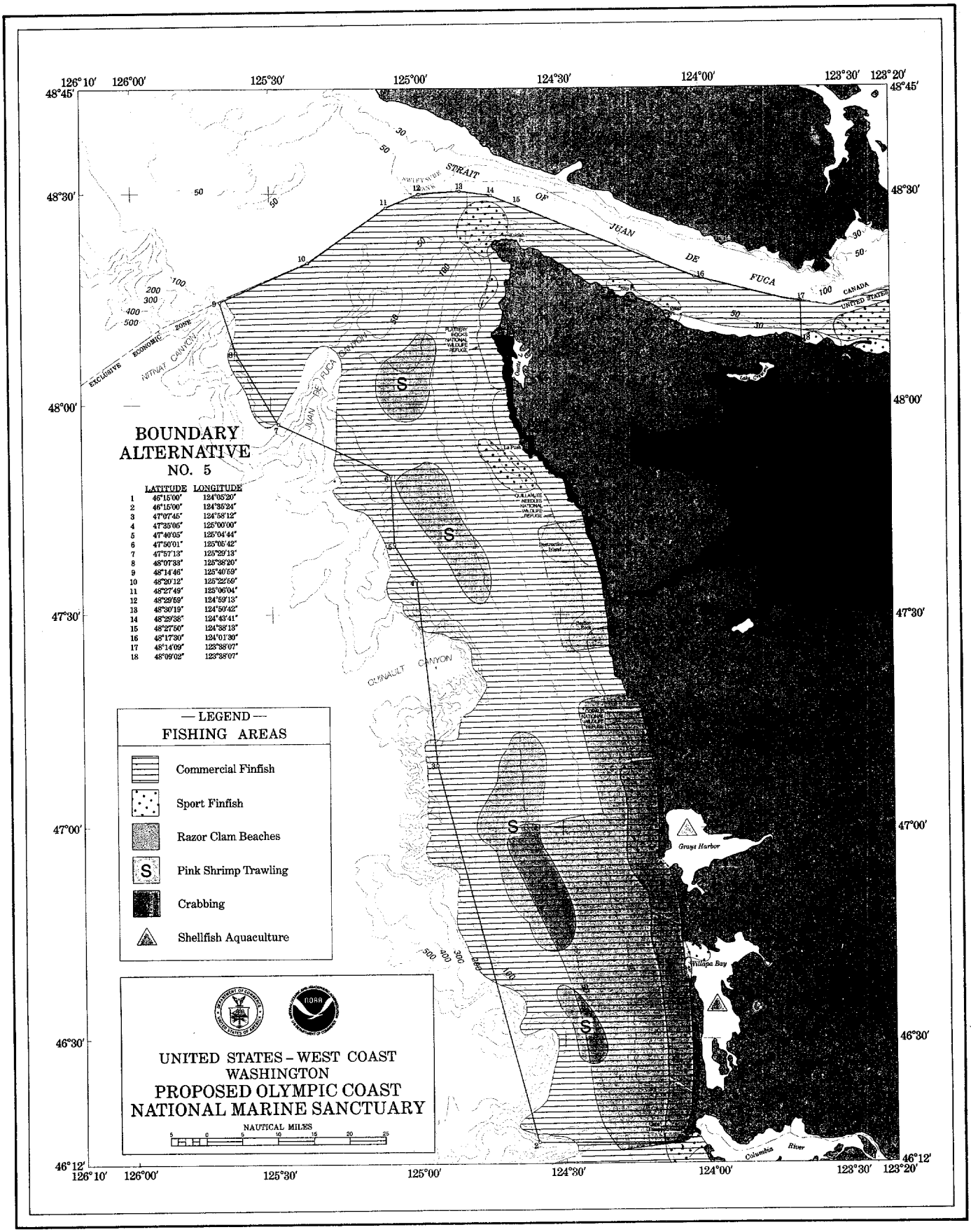


Figure 76. Boundary Alternative 5 with Respect to Fisheries.

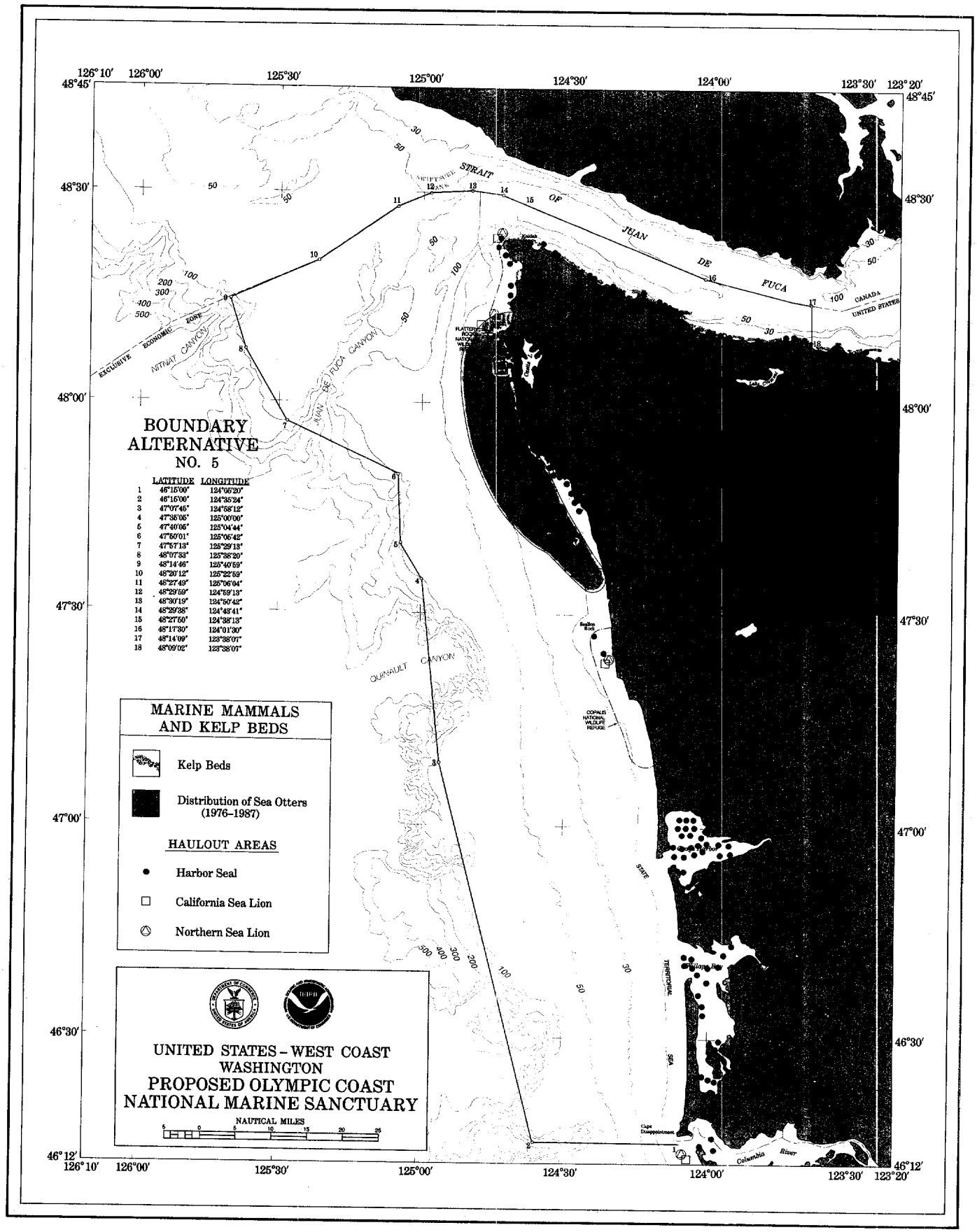


Figure 77. Boundary Alternative 5 with Respect to Marine Mammal Haulout Sites and Kelp Habitat.

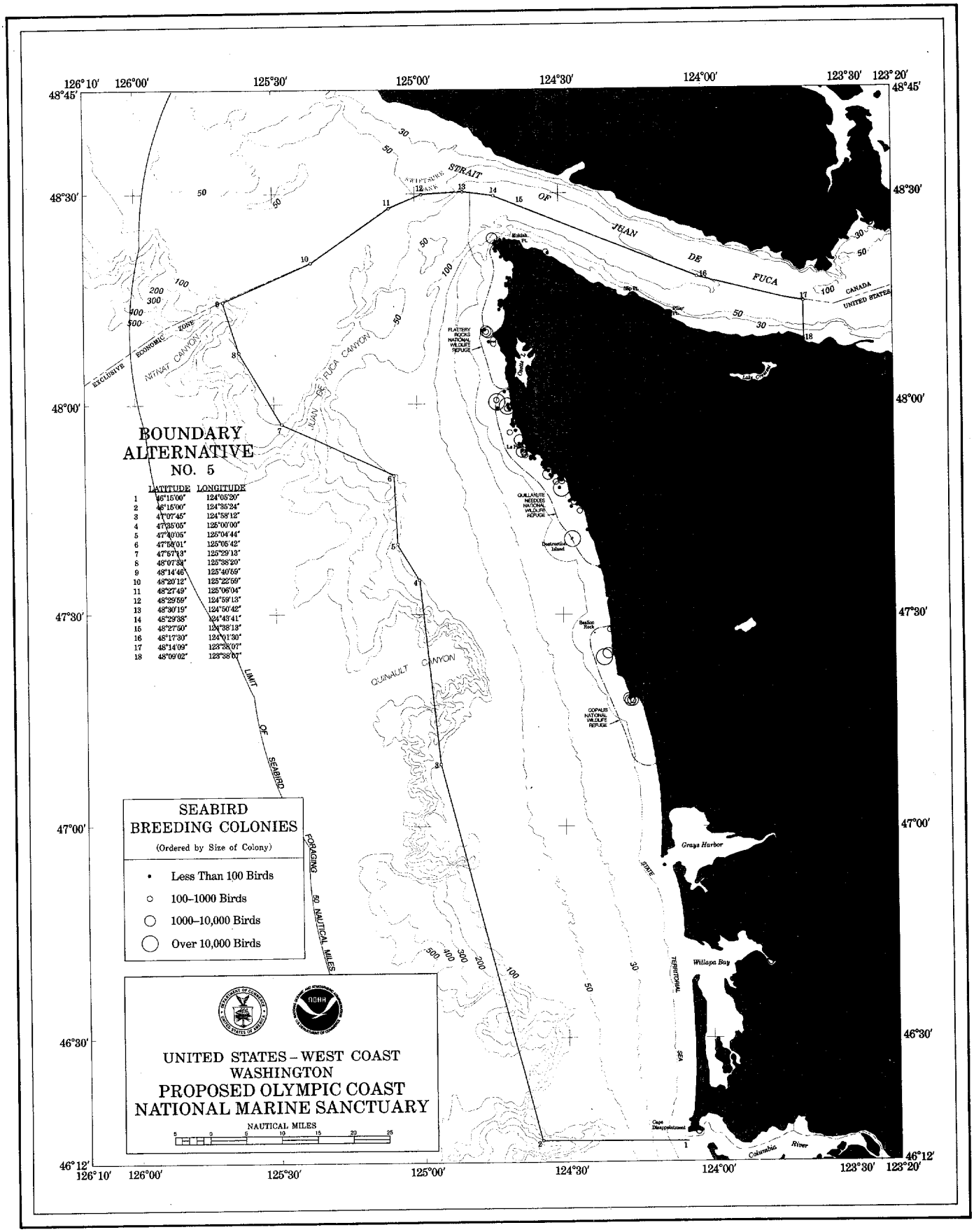


Figure 78. Boundary Alternative 5 with Respect to Seabird Colonies and Seabird Foraging Range.

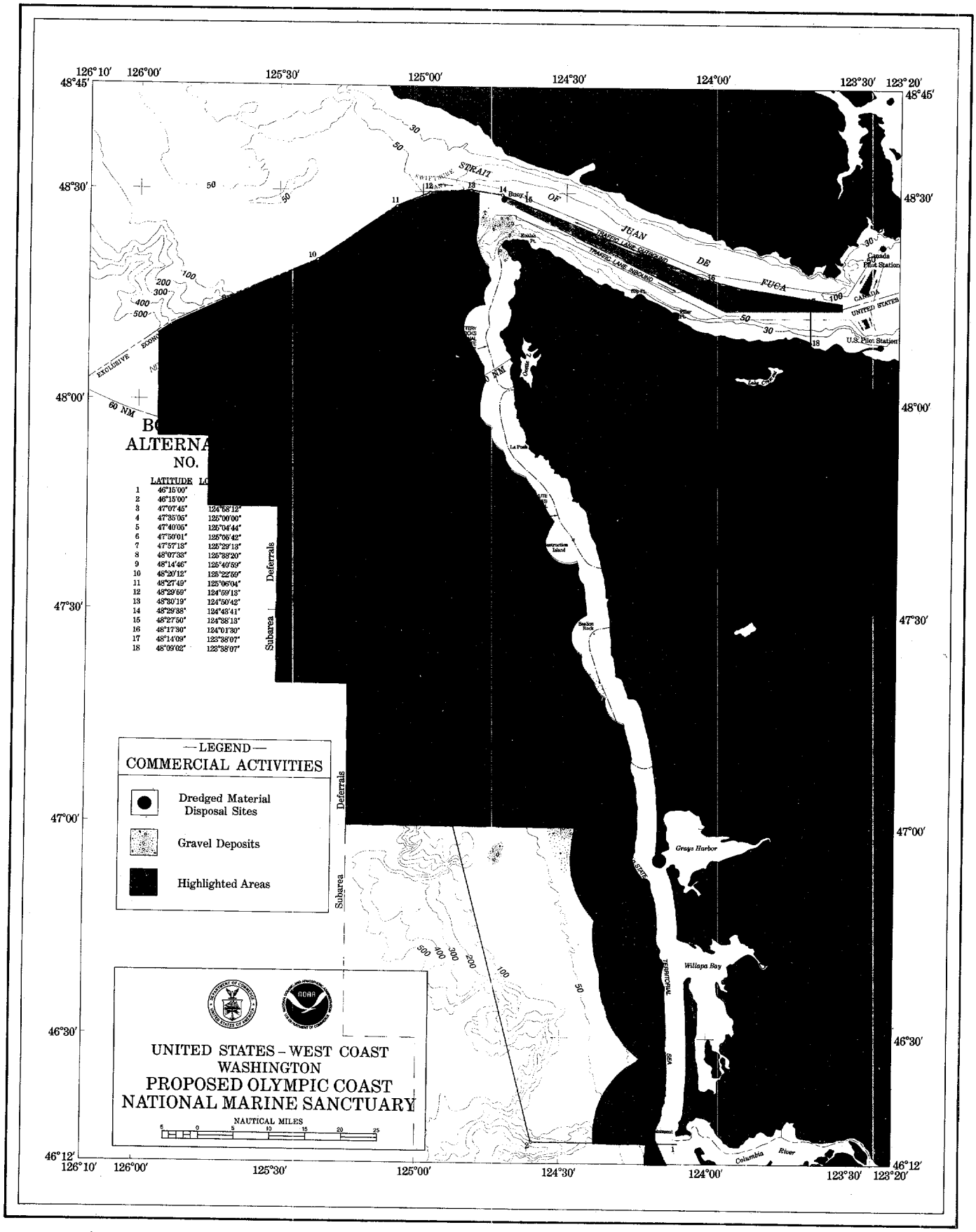


Figure 79. Boundary Alternative 5 in Relation to Vessel Traffic Management Regimes, Dredge Disposal Sites, Oil and Gas Resources and Gravel Deposits.

Section II: Regulatory Alternatives

A. Introduction

This section analyzes the environmental consequences of the eight activities included within the scope of the Sanctuary regulations. For each activity the preferred Sanctuary regulatory action is identified along with an analysis of the impact to natural resources and human uses of both the Sanctuary regulatory alternative and the status quo. There are also two regulations proposed (preferred Sanctuary action) whose purpose is to facilitate enforcement of the other Sanctuary regulations: the regulations prohibiting possession of resources and interference with enforcement.

Overall, the proposed final regulations and designation are intended to: (1) improve resource protection by instituting new regulatory measures and by supplementing present surveillance and enforcement actions; (2) minimize negative impacts to human uses, particularly to those deemed consistent with the purposes of the Sanctuary and; (3) provide for a manageable area including such factors as its size, its ability to be defined as a discrete ecological unit, its accessibility, and its suitability for monitoring and enforcement activities.

It is important to note that in promulgating these regulations, NOAA must work within the constraints of Title III of the MPRSA. Specifically, section 304(c) states that while NOAA cannot terminate valid leases, permits, licenses or rights of subsistence use or access existing as of the date of Sanctuary designation, NOAA can regulate the exercise of such authorizations and rights consistent with the purposes for which the Sanctuary was designated.

B. Oil, Gas and Mineral Activities

1. Status Quo

a. Consequence of Impact to Resources

There is presently no oil and gas development taking place in the study area. Under the most recent Five-Year Plan for OCS oil and gas leasing activities developed by the MMS, an OCS lease sale on the Washington OCS was scheduled for the spring of 1992. However, the reauthorization of the MPRSA (P.L. 102-587) mandates a permanent prohibition on oil and gas pre-leasing or leasing activities within the Sanctuary.

Currently, state law prohibits oil and gas activities in state waters. Also, Washington state has requested that MMS delete from any lease sale the portion of its planning area that lies north of the 47th parallel, and the area within 12 nautical miles of the Grays Harbor, Willapa Bay, and Columbia River estuaries.

Scientific evidence concerning the potential impacts of oil and gas activities on the natural resources of the Olympic Coast is not conclusive, and the studies planned by MMS and the Pacific Northwest OCS Task Force will address several critical questions. A recent National Academy of Sciences study (NAS, 1989) as well as past EPA (1985) and NAS (1985) studies, have examined whether there is adequate information available to determine the effects of oil and gas activities on the marine environment. It has been concluded that many uncertainties still exist, even in marine areas for which there exists far more information than exists for the Olympic Coast. However, it is still possible to evaluate some of the potential risks to the Olympic Coast from OCS oil and gas activities, and the transportation of hydrocarbon products.

Offshore hydrocarbon exploration, development, and production activities, including the transshipment of crude oil to the mainland, may cause unforeseen and potentially substantial discharges of oil, both chronic and catastrophic, into the marine environment. The sensitive marine resources of the Olympic Coast may be threatened by: (1) well "blow-outs" caused by equipment failure or damage, or geologic hazards; (2) oil spills and pipeline leaks; (3) noise and visual disturbances caused by drilling, the presence of drill rigs or platform, work crews, supply boats, and helicopters; (4) pollution associated with aquatic discharges; and (5) short-term pipeline construction upheaval.

Normal hydrocarbon operation can result in unintentional, chronic, or small oil spillage. Since the Olympic Coast area has had little history of hydrocarbon production, direct evidence does not exist to illustrate the effects of exploration, development, and production spills in these waters. Petroleum products are, however, transported along the coast and in and out

of the Strait of Juan de Fuca. Two oil spills, the General M.C. Meiggs and the Nestucca, have occurred recently in coastal waters off Washington State. Oil spilled from the barge Nestucca soiled beaches found within the boundary of the Sanctuary. The reports of damages from these incidents, as well as data from spills in other marine waters, serve as examples of the types of impacts that can result from oil related accidents. Known threats to marine organisms that may result from offshore oil and gas exploration, development, and production are presented in Table 6 (page III-19).

Even though OCS oil and gas activities may take place offshore in Federal waters, the activities can negatively effect state territorial waters and coastal environments. In addition to effecting marine organisms, these activities can disrupt human uses of the marine environment and the socioeconomic structure of coastal communities. Potential negative impacts to nearshore and coastal areas include: the presence of processing facilities which also involves the problems of air pollution and the disposal of processing wastes; interference with port operations and stress on existing port facility space and services; conflict with shore-based operations which use the offshore waters (e.g., commercial and recreational fishing, whale-watching operations); and socioeconomic impacts on the affected coastal communities (Mead and Sorenson, 1970; Cican-Sain, 1985; Freeman, 1985; MMS, 1990a).

(a) Sources of Oil Spills and Potential Impacts

Inputs of petroleum into the marine environment come from a variety of sources. Less then 2% (50,000 tons of a total estimated 3.2 million metric tons) of the annual input of oil into the world oceans is from offshore production activities. The largest input, accounting for approximately 45%, is from transportation related incidents including tanker operations, spills at terminals and dry docks, bilge and fuel oil flushing, tanker and other ship or barge accidents. Municipal and industrial wastes, and runoff account for 36.5% of the oil entering the world oceans. Other sources include natural seeps (7.7%), and atmospheric deposition (9.2%) (NRC, 1985; Boesch and Rabalis, 1987). Due to the near absence of industrial and municipal discharges along the Olympic Coast, it is clear that the major threat of oil contamination in this area currently is from tanker and barge operations.

Accidents, natural disasters, and human error can lead to situations which result in the release of oil into the marine environment. Chronic discharges, well blowouts, barge and tanker accidents, pipeline breaks and leaks, and equipment failures cause spills. The large majority of spills involve relatively small amounts of oil, usually less than 1000 gallons (24 barrels) (MMS, 1986; 1987). Small spills, defined by MMS as less than

1,000 barrels, account for almost all spill incidents in U.S. waters, but only 28% of the total volume of spilled oil. One to two barrels, on average, are spilled during routine operation for every million barrels of oil produced from offshore platforms (MMS, 1986). The cumulative long-term impact of many small spills and chronic discharges is not well understood and requires further study.

Well blowouts and tanker accidents can result in large, acute oil spills (greater than 1,000 barrels) that may have severe, long-term impacts on marine environments (MMS, 1984). In addition to blowouts, platform spills can result from leaks and small releases of fuels and lubricants. Offshore production also carries with it the risk of spills from pipelines; 95% of oil and gas produced offshore is transported by pipeline. For both Federal and state waters, the loss of oil from major spills ranges from 0.15-1 barrel of oil spilled for every million barrels produced (MMS, 1986) (note: these figures were calculated prior to the Exxon Valdez spill and other spills occurring in 1987-88).

Blowouts were the cause of sixty-five percent of oil spills associated with drilling and production from 1964 through 1980. During these 17 years, a total of 102,382 barrels were discharged into marine waters as a result of blowouts at offshore wells in the Gulf of Mexico, while about half that amount, 55,213 barrels, was spilled as a result of non-blowout associated incidents (The Futures Group, 1982). Massive spills caused by well blowouts have been highly publicized, but such spills are rare. The OCS spill-rate for platform spills of more than 1,000 barrels is one per billion barrels produced (MMS, 1986).

Most blowouts have been relatively minor, especially in recent years. From 1964 to 1981, 99.5% of the spill volume caused by blowouts in the Gulf of Mexico was spilled in the years 1964 through 1971. After 1971 the volume of blowout-produced spills was negligible, yet there was no reduction in the number of blowout spills (The Futures Group, 1982). The OCS spill-rate for small platform or pipeline spills is 379 spills per billion barrels produced or transported. Ninety-nine percent of these spills are less than 50 barrels, and 89% are less than one barrel (MMS, 1986).

Although the offshore oil industry has been successful in reducing the volume of oil spills, the record indicates that if oil development were to take place in the area of the Olympic coast, spills from blowouts, platform accidents, and transportation of crude oil to shore are likely to occur. MMS (1986) has estimated that during the 35 year life span of lease sale #132 a total hydrocarbon equivalent of 243 million barrels of oil (58 million barrels of oil and 1.043 billion cubic feet of gas) would be retrieved by a single platform drilling 30 wells.

Using a high-case and low-case production scenario, MMS has estimated rates of oil spillage off the Washington/Oregon coast should the lease sale #132 area be developed. Employing the low case scenario (58 million barrels produced) with tanker transhipment, MMS projects that 0.23 large spills would occur, with a 11% probability of a large spill occurring. The high case scenario (180 million barrels produced) estimates are 0.51 large spills projected and 16% probability of one or more large spills occurring. A cumulative scenario, which adds in the effects of oil transhipment along our coast of oil produced elsewhere changes the projected figures to 3.16 spills over the life of the field, with a 96% probability of occurring.

These MMS projections indicate that OCS oil and gas activities would increase the risk of hydrocarbon contamination along the Olympic Coast, but that the major threat is from tanker or barge oil spills. From 1974 to 1981, there were 81 tanker or barge related oil spills of more than 1,000 barrels in U.S. waters. Only six of these were on the West Coast--three in port and three at sea (The Futures Group, 1982). In 1988 and 1989 there were six significant oil spills resulting from tanker or barge accidents. Three of these tanker oil spills occurred on the east coast and three on the west coast.

The largest of the three east coast spills occurred on June 24, 1989 when Uruguayan oil tanker Presidente Rivera ran aground near Philadelphia, releasing 800,000 gallons of oil into the Delaware River. On June 23, 1989, the Greek-registered World Prodigy grounded on Brenton Reef near Newport in Narragansett Bay, Rhode Island dumping 300,000 gallons of oil. Also on June 23, 1989, the tanker Rachel B. collided with a barge resulting in 6,000 gallons of oil spilling into the Houston Ship Channel.

Other spills occurred off the west coast: the tanker Puerto Rican near San Francisco in 1984, the Oil barge Nestucca off Grays Harbor, Washington in 1988, the General M.C. Meiggs off Cape Flattery, Washington, and the Exxon Valdez near Valdez, Alaska in March 1989. The Exxon Valdez ran aground on Bligh Reef off of Valdez, Alaska and spilled 242,000 barrels (over 10,100,0000 gallons) of crude oil onto the shores of Prince William Sound. This was the largest oil spill to date in U.S. waters. The Exxon Valdez disaster has received much publicity and scientific investigations are currently underway investigating the long-term effects of the spill and possible future management measures (CMC, 1989).

The tanker Puerto Rican broke apart approximately eight miles seaward of the Golden Gate Bridge after becoming disabled by on-board explosions. The tanker released 48,000 barrels of hydrocarbons into the ocean and of this amount, only 1,460 barrels were recovered during cleanup operations (USCG, 1985). This spill killed an estimated 2,874 seabirds, and caused

additional damage to water quality, fishery resources, marine mammals, and human uses. For comparison, in February, 1986, the tanker barge Apex Houston spilled some 600 barrels of oil along the central California coast killing an estimated 9,817 seabirds within the Gulf of the Farallones National Marine Sanctuary.

The Nestucca and Meiggs spills occurred off the Washington coastline, and the oil spilled affected coastal areas found within the boundaries of the proposed sanctuary. These accidents demonstrate the seriousness of potential hazards to the proposed sanctuary resources and environment from spilled oil, regardless of its source.

On December 22, 1988 the barge Nestucca was struck by its tug the Ocean Service. The barge released 231,000 gallons of NO. 6 fuel oil into Grays Harbor and coastal waters polluting the shoreline from Grays Harbor to Cape Flattery. In addition, oil polluted beaches inside Grays Harbor and along the western shoreline of Vancouver Island, in British Columbia, Canada. The resulting oil slick covered over 800 square miles and more than 110 miles of the Washington coastline. Cleanup response was started immediately and actual cleanup efforts were underway by December 23, 1988. As of August 1989, very little visual evidence of the spill remains on the beaches, though long-term impacts to marine biota are not known.

An assessment of damage resulting from the oil spill has not yet been completed, although short-term impacts are known. Over 10,300 oiled waterfowl (mostly murres and grebes) were collected (WDOE, 1989). Although No. 6 fuel is a relatively low toxicity oil, it is highly viscous, maintains large slicks on the water surface, weathers slowly, and kills by physical contact and smothering.

Of the 10,300 birds collected after the Nestucca spill, approximately 9,300 were dead or died at the bird rescue center. It is likely that this number of dead birds represents only a small portion of those birds affected because many oiled birds were not collected because of sinking, predation, hiding, and burying.

Another example of an oil spill accident in the vicinity of the proposed Olympic coast sanctuary is the General M.C. Meiggs. While under tow, the unmanned troopship broke loose and grounded 10 miles south of Cape Flattery in January, 1972 spilling approximately 55,000 barrels of Navy special fuel oil. Prevailing winds blew oil globules onto beaches where the oil became incorporated into the sediment. For the period of a five-year study, oil persisted in the intertidal area of a contaminated cove, causing the intertidal organisms to be continuously exposed to the oil. Some primary observations of the study were that hydrocarbons taken up by mussels persisted in

their systems for five years after the spill, and 70% of surviving sea urchins lost their spines (Clark et al., 1978).

These oil spill events demonstrate a number of concerns related to oil spills in general:

1. The size of the spill does not necessarily correlate with the resulting damage to the environment.

2. For many oil spill incidents, exemplified primarily by the two spills in California and the Valdez disaster, the existing capability to contain and clean up the spill is not sufficient. The areas affected are coastal marine waters, and to be effective clean-up equipment requires less turbulent conditions than normally encountered in the waters off the Olympic Coast.

3. Mitigating measures alone may not be sufficient to ensure adequate protection of sanctuary resources.

These oil spill incidents, especially those occurring off the Washington coast, illustrate the vulnerability of the Sanctuary environment and resources to the potential impacts from oil and gas activities and hydrocarbon transportation. Lack of sufficient baseline information collected on the Olympic Coast makes it impossible to determine or predict the full extent of potential impacts. Some research in the Olympic Coast area has, however, shown that negative impacts from oil and gas activities (including seismic surveys and exploratory drilling) on the highly valued fisheries; vulnerable stocks of sea otters, fur seals, and seabirds; and other coastal marine resources are potentially great (Wahl, 1984; EPA, 1985; Felleman, 1985; Battelle, 1987; Bowlby et al., 1988; Grader and Laychack, 1989).

Seasonal sensitivity of certain species to a possible oil spill must also be considered. In the Olympic Coast area certain species of marine mammals and birds are seasonally present in numbers representing an ecologically significant percentage of their entire population (as discussed in Part II Section 2). Potential harm to marine organisms would be magnified if an oil spill were to occur during a period of high density or during a breeding season. The concept of seasonal susceptibility has been highlighted by the U.S. Bureau of Land Management (1979) in regard to the marine resources surrounding the Northern Channel Islands, off Santa Barbara, California.

Consideration of the physical oceanographic dynamics is important in protecting sanctuary resources from possible contaminants transported by currents and eddies. Oil spill trajectory models have not been developed for the Washington coast primarily due to the limited amount of detailed current and wind data that is available. Studies recommended by MMS and the

Pacific Northwest OCS Task Force would allow for the development of trajectory models. Available data for mean wind, wave, and currents, however, indicate that the sanctuary area is vulnerable to spills occurring outside the proposed boundaries. On the average, surface currents over the shelf travel northward and shoreward in the winter months and southward and seaward in the summer, with transitional periods in the spring and fall. Coastal upwelling occurs during the summer months, bringing deep water to the surface, while downwelling occurs in the winter. Prevailing wind direction is northward in the winter, and southward in the summer with a strong shoreward component during all seasons. Wave directions are shoreward over the entire year, and mean flow along the bottom is northward during all seasons.

(b) Effects of Hydrocarbons on Living Marine Organisms

Although most spilled crude oil initially floats, approximately 1% - 5% of the volume of a surface slick will occur in the water column as a result of dissolution, dispersion, sinking, or sedimentation in the vicinity of the spill. Additional oil may be retained in the water as the result of a lesser known mechanism, the formation of a subsurface oil plume. Because the oil in such a plume remains below the surface it may have a different chemistry than the surface slick and be more toxic to marine organisms. In the case of the IXTOC blowout, which occurred in June, 1979 in Mexican waters of the Gulf of Mexico, it was found that a subsurface plume of oil droplets, extending from the wellhead and generally aligned with the surface slick, contained high concentrations of low molecular weight aromatics, alkyl benzenes and naphthalene compounds which are acutely toxic to marine organisms (MMS, 1986).

The toxic effect of oil on organisms can be short-term, long-term, lethal or sublethal. Toxic effects on different organisms vary and depend on a number of factors including: chemical composition of the oil; environmental factors such as temperature, salinity, and viscosity; the level of feeding and reproductive activity by the organism; and differences in susceptibility among species and among life cycle stages within the species. The sublethal effects of hydrocarbons on marine organisms include: the disruption of normal feeding behavior, breeding, and locomotion; interference with thermo-regulation; reduced resistance to stress; and diseases caused by the intake of carcinogenic or potentially metagenic chemicals (MMS, 1986). At the tissue level, lesions may develop on the skin, gills, or intestine (Hawkes, 1977). Some organisms, however, may have the ability to compensate for minor toxic stress and may thus be able to tolerate low concentrations of toxic hydrocarbons.

A large amount of research has been completed showing the sensitivity of commercially important fish, shellfish and non-

commercial invertebrates. Effects to these organisms are summarized by Strickland and Chasan (1989).

Sublethal and long-term hydrocarbon impacts on ecosystems are associated with low oil concentrations in marine environments which may result from the evaporation, degradation, and dispersion of hydrocarbons following a large spill or from chronic, low-level, small spills (less than 1,000 barrels). Of the two, chronic small spills may pose a greater hazard to marine ecosystems than isolated large spills. The damage resulting from the Nestucca, Apex Houston and Puerto Rican spills illustrate that even small spills, in the short term, can kill a large number of individual birds or other marine organisms. Oil can directly affect living marine organisms biochemically or physically (see, for instance, Boesch et al, 1973; Michael, 1977; National Research Council, 1985; EPA, 1985; MMS, 1987; Boesch & Rabalais, 1987).

The greatest damage to the marine environment occurs under any of the following circumstances: (1) The oil is spilled into or reaches a confined, shallow body of water, such as an estuary; (2) the oil is refined oil, such as home heating oil or diesel oil; (3) storms or heavy surf cause the oil to be churned into the bottom sediments. In many instances, it does appear that the marine ecosystem can recover from the damage occasioned by oil spills although the rate and completeness of recovery remain subject to dispute.

Petroleum hydrocarbons can also have sublethal or indirect lethal effects on marine organisms through the destruction or alteration of food supply, through chemical interference with reproductive success, synergistic effects which may reduce resistance to disease, and other stresses which alter behavioral patterns such as feeding. The physical damage resulting from the coating of marine organisms (e.g., feathers of marine birds, fur of marine mammals, and respiratory apparatus of fish) with oil is well documented (see, for instance, U.S. Bureau of Land Management, 1979). Below is a summary of the impacts of oil spills on the biological resources and uses of the Olympic coast and offshore waters.

Oil Spill Impact on Pinnipeds and Sea Otters:

Floating oil can foul the fur or skin, and irritate the eyes and membranes of pinnipeds and sea otters, and cause harm when the oil is ingested or inhaled (U.S. Bureau of Land Management, 1980; Geraci and Smith, 1977). Oil contamination can cause loss of buoyancy, and impairment of normal thermal regulation. Of the two, impairment of the body's insulation properties is probably more damaging, particularly for fur seals and sea otters which depend primarily on the fur for insulation (U.S. Bureau of Land Management, 1980).

Although northern fur seals depend only partially on their fur for thermal protection, oiling could depress their thermoregulatory abilities, which could lead to hypothermia and death (Kooyman, et al., 1977). Studies by Kooyman, et al., (1977) indicate that among sea mammals, the most profound effects of oiling may be on the sea otter pup: its thermal conductance increased by 2.1 times after oiling, indicating a significant loss of insulation capacity. The results of Kooyman's later studies confirm that even a light oiling could have marked detrimental effects on the thermoregulatory abilities of otters (Kooyman and Costa, 1979). The limited migratory abilities and lack of a blubber layer make sea otters even more vulnerable to oiling (Strickland and Chasan, 1989).

The sea otters which inhabit the nearshore areas within the proposed sanctuary are a Washington state endangered species and their distribution is localized to a specific stretch of the coastline. The sea otters were reintroduced to the area in the 1970's after being hunted to extinction before 1910. The localized distribution of this sea otter population makes them even more vulnerable to the effects of spilled oil than other more established sea otter populations. One oil spill could eliminate the entire population.

Phocid seals rely on blubber and vascular mechanisms for thermal regulation and are thus more resistant to thermal loss caused by contact with oil (Geraci and St. Aubin, 1980). Phocid seals of the Olympic Coast include the northern elephant seal and harbor seal.

The ingestion of oil by pinnipeds is most likely to occur during feeding or as the animals clean their coats. The impact of such ingestion depends upon the amount ingested, its toxicity, and the physical condition of the pinnipeds. The long-term effects on pinnipeds of various levels of hydrocarbon bioaccumulation are largely unknown. Longer-term effects may result from subtle changes in habitat and intrinsic stressors within the environment rather than direct mortality (Boesch & Rabalais, 1987).

Oil Spill Impacts on Cetaceans:

Effects of oil on cetaceans include: damage to skin or eyes upon contact, the fouling of baleens, and physiological effects of ingestion, and inhalation. Because the skin of cetaceans is smooth and furless, oil is unlikely to adhere to it, although it may adhere to the callosities that occur on right and humpback whales. In a study of bottlenose dolphins to determine the effects of direct skin contact with spilled oil, it was found that exposure to crude oil for periods of up to 45 minutes produced short-term, morphological, and biochemical changes to the skin. Recovery appeared to be rapid following the oil

exposure (Geraci and St. Aubin, 1982). Since whales depend on blubber rather than fur for thermal regulation, oil would generally not affect their ability to thermoregulate. How cetaceans react to an oil spill on many variables including the species type, time of year, and severity of the oil spill.

Although the effects of oil on cetaceans have not been carefully investigated, scientists hypothesize that oil could cause short-term and long-term harm. Scientists hypothesize that cetaceans may suffer eye irritation as the result of contact with oil, and that Baleen whales, such as the gray whale which migrate through Olympic coast waters, are subject to baleen fouling as a result of exposure to spilled oil. The southern migration includes pregnant females, and the return migration to arctic waters includes females accompanied by calves. Both pregnant females and calves may be more susceptible to oil pollution than male adults.

The bioaccumulation of oil in both baleen and toothed cetaceans can occur as the result of eating contaminated food supplies. There is little likelihood that oil would be inhaled through the blow-hole, although it is possible the whales might inhale small quantities of toxic fumes (Geraci and St. Aubin, 1980). Although the effects of hydrocarbon accumulation in cetaceans are unknown, one can assume that the longer an animal is exposed to spilled oil, the more likely it is to suffer adverse effects. Prolonged exposure is most apt to occur when feeding grounds are contaminated. For example, because baleen whales are filter feeders, they may ingest oil or oil-tainted substances. Gray whales that migrate through the sanctuary area are susceptible to contamination since they feed on nearshore bottom organisms.

Oil can destroy fish eggs which in turn can upset the delicate balance of the food web, and thereby diminish an important local food source for some species. In addition, oil effects may reduce a mammal's ability to find food, flee from predators, and care adequately for their young. Although bioaccumulation can occur, there currently is no data available showing that accumulation of oil through the food chain will result in a biomagnification effect on cetaceans.

In general, little is known about the ability of cetaceans to avoid oil spills. Humpback whales, however, have been observed feeding in oil-slicks without apparent immediate ill effects (NOAA, 1979). Other cetaceans such as the bottlenose dolphins can detect and will avoid thick oil accumulations, but not thin oil sheens (Geraci and St. Aubin, 1982, 1983). Experiments have also shown that dolphins can detect oil and, under certain circumstances, will avoid oil (Boesch & Rabalais, 1987). The likelihood of prolonged exposure is diminished if the slicks are avoided and even if certain species move through at

normal speeds.

Oil Spill Impact on Marine Birds:

Oil spills can seriously harm or kill seabirds, which are one of the most vulnerable animals to oil spills. The impacts on seabirds from the Nestucca spill clearly demonstrated this fact. Over 10,000 seabirds were killed in the days and weeks following the Nestucca spill. The major cause of immediate mortality among seabirds contaminated by oil is fouling of the feathers, which reduces flying and swimming ability and results in a loss of buoyancy and thermal insulation. It is generally assumed that most birds that are oiled as a result of a major spill will die (Hunt in MMS, 1989). The ingestion of toxic hydrocarbons, sometimes by preening contaminated feathers, can produce physiological stress which may eventually result in death. If non-fatal contamination occurs during the breeding season it may lead to reproductive abnormalities and failures. Birds that have ingested toxic elements may produce inviable eggs, and birds whose feathers are contaminated may transfer oil to eggs or chicks, thus reducing hatching or fledgling success. Other laboratory and field studies have shown that the ingestion of petroleum products can cause physiological damage and potential disruption of reproductive function (Hunt 1987; Fry 1987 in MMS, 1989).

A number of factors influence the vulnerability of different species of birds to contact with spilled oil. Species which have a tendency to form large, dense flocks on the water, spend considerable time swimming on the water, or dive when alarmed are extremely vulnerable, as are species which exist in small, isolated populations (U.S. Bureau of Land Management, 1980).

Diving birds and species that spend a considerable amount of time resting on the water are especially vulnerable to contact with spilled oil. The alcid seabirds, which dominate the population of seabirds on the Olympic coast (e.g., compose 86% of the nesting seabird populations), are also vulnerable due to their concentration in dense colonies. Dominant species in this group are Cassin's auklets, common murres, rhinoceros auklets, and tufted puffins. Destruction Island hosts one of the seven major colonies of rhinoceros auklets in the world. The Copalis Rocks Refuge contains 82% of the Brandt's cormorants, 77% of the common murres, and 39% of the rhinoceros auklets breeding in the state of Washington.

Local populations of cormorants and waterfowl are vulnerable because they represent a large portion of the local total population, the populations are low, and they would most likely recover slowly (Strickland and Chasan, 1989). Shearwaters and terns are also vulnerable but less so than diving birds. Marbled murrelets (which are being considered by USFWS for inclusion on

the threatened species list) have the highest oil/bird vulnerability index of any seabird because they feed in local concentrations close to shore.

Catastrophic oil spills, like the 1971 Golden Gate spill, generally result in extremely high marine bird mortality. Other major oil spills, such as England's Torrey Canyon incident in 1967, have affected far larger numbers of birds than did the Golden Gate spill and have resulted in very high bird mortality (Holmes and Cronshaw, 1977) Attempts to clean oiled birds often prove unsuccessful and may occasionally cause even more stress than light oiling.

Oil pollution threatens bird populations beyond immediate mortality from ingestion of oil or fouling of feathers. Because of their direct dependence on nearshore food sources, long-term contamination of foraging grounds could cause major alterations in marine reproductive capabilities. As with marine mammals, birds may be adversely affected by the ingestion of oiled invertebrates. The potential long-term, cumulative impacts of nearby oil and gas development on marine bird habitat areas and feeding grounds in the Olympic coast area remain largely unknown.

Oil spill treatment and cleanup operations (including the adverse effects of human intrusion) can also have serious impacts on marine birds and marine mammals. Often the emulsifiers used and the associated human activity during cleanup procedures have been more harmful than the oil (MMS, 1987). Because many new generation dispersants, which are supposed to be no more toxic than oil, have not yet been fully evaluated, their environmental effects remain largely unknown (MMS, 1987). Mechanical cleanup and containment devices, such as booms, pose no toxic threat to marine birds, however, the extensive human activity associated with deployment can cause social disturbances within the marine bird and mammal populations. As with oil spills themselves, the impacts of cleanup operations would be particularly severe at times when marine birds and mammals were highly concentrated, e.g., during breeding or feeding activities.

Oil Spill Impact on Fish, Planktonic and Benthic Biota:

Oil spill impacts on the fish stocks and benthic fauna of the Olympic Coast waters would depend largely upon the type of oil involved (solubility, toxicity, etc.), the timing of the spill with respect to reproduction and larval development, migration patterns, and prevailing weather conditions.

Both lethal and sublethal effects of petrochemical pollution have been noted in fish (Hawkes, 1977; Patten, 1977; Sniderman, 1979, 1982). Observed sublethal effects range from visible physical abnormalities to subcellular defects. Some fish exhibit severe anatomical deformities such as curvature of the spine. At

the tissue level, lesions may develop on the skin, gills, or intestine (Hawkes, 1977; Sinderman, 1982). In addition to any possible health hazards from the consumption of contaminated fish by humans, these sublethal effects are aesthetically displeasing and increase the difficulty of marketing fish for human consumption.

Patten (1977) and Sinderman (1978) discuss changes in behavior, metabolism, locomotor and activity patterns, growth, feeding and reproduction. Laboratory research, for example, has demonstrated deleterious effects on the survival and growth of eggs and larvae during spawning conditions due to short, low-level hydrocarbon exposures (Whipple et al., 1978). These laboratory results do not necessarily predict the effects of open ocean exposure to hydrocarbon discharges, where levels of contaminants may differ.

The lethal toxicity of oil ranges from .1 to 100 parts per million of soluble aromatics for adult marine organisms. Larvae are usually 10 to 100 times more sensitive than adults. Sublethal effects have been demonstrated with aromatic compounds in concentrations as low as 10 to 1,000 parts per billion (Johnston, 1979). The impact of a spill is thus apt to depend on the magnitude of egg and larval mortality. Because the early life stages are often pelagic, they are more susceptible to the effects of a surface slick. Heavier hydrocarbon elements are characterized by aromatics of higher molecular weight and lower water solubility. These elements may be avoided by adult finfish, but benthic organisms are highly susceptible to the lethal effects.

Although offshore production in general may be compatible with healthy fisheries in some areas, studies following past oil-tanker spills demonstrate some long-term damage from crude oil in the near shore area. Studies plaice, centered on breeding grounds and estuarine habitat, show 27 months after the spill, recovery of the fishery, although improved, was still not complete (Neff and Haensly, 1982).

A large oil spill in, or close to, valuable fishing areas poses a potentially serious threat to Washington State's valuable sport and commercial fisheries, including aquaculture. Oil spills or chronic exposure can affect fisheries through loss of fishing time or gear, tainting of fish, and direct destruction of the fishery. The most serious long-term effect is lingering tainting of stocks (Michael, 1977). Although direct toxic effects on an entire fishery of finfish whose populations cover large areas are not probable, smaller fishery segments can be seriously harmed. Generally, fisheries are most vulnerable during the reproductive and juvenile stages. Many species concentrate in small geographic areas during these stages increasing the potential for serious ecological consequences as a

result of contaminant concentrations.

In the waters of the Olympic coast, salmonids are very important to both the commercial and recreational fishery. They are susceptible to spills which could occur near estuaries and river mouths. Some lethal and sublethal effects of adult salmon exposed to oil in laboratories include tissue damage, narcosis, and reduction in the ability to sense "home" waters. Tainting of the salmon flesh, which can spoil the catch's marketability, poses a serious threat to the commercial fisheries. A large potential risk from spilled oil exists for juvenile salmon during their migration into salt water from rivers and estuaries. Groundfish are also vulnerable to spilled oil at all life cycle stages; the groundfish catch off the Washington coast has exceeded that of salmon (Strickland and Chasan, 1989).

Shellfish, particularly Dungeness crab, pink shrimp, razor clams and oysters are also important fisheries of the Olympic coast region. Crab and shrimp eggs and larvae float in the water and are extremely sensitive to lethal and sublethal effects from hydrocarbon exposure. Razor clams and oysters are particularly susceptible to the effects of oil because they are immobile filter feeders (Strickland and Chasan, 1989). A major oil spill could cause significant long-lasting damage to the production of clams and oysters along the Washington coast.

The effects of oil and gas activities on kelp are serious particularly because kelp is a critical habitat for many species of fish. It is generally believed that the susceptibility of kelp and other plants to oil pollution varies with life stage, and that the adult kelp generation has an outer mucilage covering which appears to protect it against oil toxicity (U.S. Bureau of Land Management, 1979). While there appears to be little evidence to indicate that kelp is harmed by oil, the fish and fauna which live in the kelp may be harmed by ingesting, or coming into contact with, the oil trapped in the fronds.

Drilling and production platforms may form an artificial reef environment which could have short-term benefits for some fishery species. The fishery habitat remains in existence only during the life of the field and disappears once the platform is removed. This limited enhancement must be balanced against threats posed by oil and gas production.

Oil Spill Impacts on Estuaries, Wetlands, and other Critical Coastal Habitats:

The intertidal area is an important breeding, spawning and feeding ground for many marine organisms; the area also provides substrate and suitable habitat for many other species. Oil in the intertidal zone can affect the benthic biota by smothering, fouling, or directly poisoning organisms (Michael, 1977). As a

result of the Valdez and Nestucca spills, for example, a significant amount of oil washed up on beaches, rocky shorelines and bays. A tanker collision spill, which occurred at the Golden Gate Bridge in 1971, provides an example of oil contamination in mussel beds located on the high rocks at Duxberry reef. Although comparison of pre-oil and post-oil transects showed a significant short-term decrease in marine life after the oil spill, the visible signs of oil passed rather quickly with no long term damage documented (Chan, 1977). Oil spills, however, pervaded the upper tidepool waters almost a year following the accident and there was selective evidence of marginal organism recruitment.

Wetlands and estuaries are critical coastal habitats for a number of the species discussed in Part II. These areas are highly productive areas that are important in sustaining offshore oceanic biota with nutrient resources as well as habitat for part of their life-cycles. Estuaries are critical rearing areas for juvenile flatfish and other groundfish, salmonids, crab and other significant species.

The estuaries of the Washington coast are poorly flushed soft-bottom embayments which can retain harmful oil residues and delay biological productivity. Once in the sediments of an estuary, oil can remain for years and destroy the entire ecosystem (MMS, 1987). If the substrate is heavily oiled, erosion can increase by 24 times (MMS, 1987) and thereby permanently alter the morphology and physical fluid dynamics of the estuary. Finally, according to MMS (1987) it is extremely difficult to protect estuary mouths by sealing them off if they are larger than 100 m. The openings to both Grays Harbor and Willapa Bay are greater than 100 meters in width and are therefore especially vulnerable to oil spills.

(c) Impacts From Discharges (other than oil) From OCS Activities

A wide variety of pollutant discharges are normally associated with OCS oil and gas development: drill cuttings and muds, sewage and trash, formation (or produced) waters, marine corrosion products, and air pollutants (e.g. petroleum aerosols and exhausts). Hazards to living resources from oil development operations can result from the on-site discharge of drill cuttings and drilling muds. These materials may adversely affect benthic biota as well as fishery resources, seabirds, and marine mammals. Drilling muds consist of naturally occurring minerals such as barite, simple chemicals such as sodium hydroxide and potassium chloride, and complex organic compounds such as lignosulfonates and formaldehydes. Department of the Interior OCS Order Number 7 forbids the discharge of drilling muds containing toxic substances into ocean waters.

In 1983, the Marine Board of the National Research Council

conducted a study of drilling discharges. The study found that these discharges present minimal risk to the marine environment. The Marine Board did note, however, that drilling discharges do have an impact on the immediate benthic environment (National Research Council, 1983). However, more recent research (EPA, 1985) has shown significant benthic impacts from platform discharges up to two miles from a drilling site. Rocky reefs and hard-bottom areas off the Washington coast are susceptible to impacts from drilling fluids and muds.

Fluids and the lighter elements in drilling discharges rapidly disperse in the water column. The heavier elements, over 90 percent of the discharged material, settle to the bottom, usually in a plume extending in the direction of prevailing bottom currents. The potential impacts on marine organisms resulting from the discharge of drilling muds and cuttings are: 1) decreased primary production caused by increased turbidity which reduces light levels; 2) interference with filter feeding caused by high particulate loads; 3) burial of benthic communities; and 4) injury resulting from the acute or chronic toxic effects of drilling mud constituents.

Air pollution discharges normally associated with hydrocarbon activities (e.g. nitrogen and sulfur dioxides, carbon monoxide, particles, and organic fumes) can affect and potentially degrade local air quality. The discharged gases originate from a number of activities directly associated with oil and gas development including: flaring of excess gas, motor emissions from the platform, vessel traffic, onshore facilities, and petroleum fume releases from normal operational spills. Impacts on air quality from these gases depends on local meteorology and wind conditions. MMS projects possible impacts to the Puget Sound area, and minor impacts to the coastal area.

(d) Acoustic and Visual Disturbances

Oil and gas platforms, rigs, and related activities create both a visual intrusion on the scenic qualities of the area's seascape, and disturbances from construction activities and the sound and movement of boats and helicopters (U. S. Bureau of Land Management, 1979). Seismic survey equipment can interfere with fishing activities. In December, 1980 more than 1200 crab pots were caught in the airgun array of a vessel conducting a geophysical survey in Federal waters off Washington, causing in excess of $100,000 damage to fishing gear alone. As these pots were rendered irretrievable, they continued to catch crab. The Washington Department of Fisheries estimated a 5% loss of the offshore crab resource and untold opportunity costs as a consequence of this incident alone. The acoustic signals used during surveys have been shown to decrease catches of some rockfish species, kill fish eggs and larvae that are present near the generating apparatus, and alter swimming behavior in gray

whales. The continuous human activity associated with oil and gas development and the steady stream of crew and supply boats create visual impacts and noise which may disturb marine birds and marine mammals, particularly during sensitive nesting, pupping, and migration seasons. Pinniped stampeding or sudden flights by nesting birds can occur if these disturbances occur very close to shore (U.S. Bureau of Land Management, 1979). During critical breeding periods, such reactions could result in increased mortality rates in young marine birds and marine mammals (U.S. Bureau of Land Management, 1979). The Washington Department of Ecology is funding an analysis of probable biological impacts from seismic testing to be completed in the summer of 1990.

Due to the undeveloped nature of the Olympic Coast area, the presence of an oil rig offshore would detract from the wilderness experience derived from visiting the beaches along the sanctuary shoreline. MMS (1989) stated that platform construction will create unavoidable adverse impacts to the visual resources, and that these impacts would last the life of the projected OCS activity.

(e) Socioeconomic Impacts

The socioeconomic consequences of prohibiting oil and gas activities within the sanctuary include effects on local communities and industries such as tourism and fishing. Prohibiting oil and gas development within the sanctuary will result in net positive effects on the local communities by reducing threats to the natural resource based economies.

Most of the revenues produced from oil and gas development would flow to the oil industry, while most of the impacts would be borne by the local communities and state government. If oil and gas development were to proceed, local communities might experience the short and long term effects of the boom-bust phenomenon. The local communities along the Olympic coast have traditionally relied on natural resources (e.g., timber, pulp, and fish) for the basis of their economy. The economy of these communities is chronically depressed and unemployment has been higher than the Washington state average. The expected employment benefits for the local communities is minimal. MMS's low case scenario predicts that 1,176 jobs would be created at the development stage. Estimates indicate that at the development stage a platform would employ 105 people per 12 hour shift and 175 people per 7 hour shift. Most of the skilled jobs located on the drilling rigs would be filled by non-local workers. The influx of outside workers could produce some problems in small communities. Past experiences dictate that increased population could increase: housing prices, certain types of crimes, traffic, demand for social services, and need for government spending.

Construction work might be made available to the local residents, although there is no guarantee that the lessee would hire locally. Even though a very small amount of jobs may be created, the minimal employment might have a significant short term benefit to the smaller communities. After the production stage the work force would rapidly decrease and eventually diminish completely.

Offshore oil and gas activities may also significantly affect fishing activities with or without consideration of a major oil spill. The impacts on fish populations following a major spill have already been addressed above. It must also be recognized that OCS oil and gas exploration and development may create spatial conflicts with fishermen, both offshore and at dockside. At the exploration stage, the gear employed during seismic surveys could become entangled with crab pots and other fixed gear, and have in the past off Washington. Placement of a platform could cause similar but more severe space use conflicts since the platforms would remain offshore for the life of the lease. While platforms can serve as artificial reefs, which could enhance the fishing from charter or privately owned fishing boats, commercial trawlers may suffer economic losses by having to avoid the platforms. This, of course, would depend on whether the rig was placed within a popular fishing area. There is also potential for conflicts between supply boats and fishing vessels over harbor space for docking or anchoring. This dockside spatial conflict has occurred in the Gulf of Mexico where oil companies and the fishing industry compete for dockside facilities.

b. Consequences of Impact to Uses

Under the status quo, no oil or gas will be developed within the Sanctuary. This action adds further protection to the coastal resources and fishing and tourist industries from the potential impacts of oil and gas development. This action also maintains the undeveloped viewshed. Further, there will be no social impacts of oil and gas development on coastal communities. The impacts of the industry on coastal communities may be both positive and negative. Development would bring economic development to coastal communities suffering from unemployment and seeking new opportunities for economic growth. The oil and gas industry, however, tends to employ individuals with specialized skills and would likely import labor. The importation of labor to develop oil and gas resources off the coast may result in cultural conflicts with the existing population, and overly stress the existing community infrastructure which is insufficient to handle such growth (MMS, 1990).

2. Sanctuary Alternative (Preferred)

a Consequence of Impact to Resources

NOAA is implementing through Sanctuary regulations the Congressionally mandated prohibition on oil and gas exploration and development within the boundary of the Olympic Coast National Marine Sanctuary. Further, the Sanctuary regulations prohibit all mineral development and exploration within the Sanctuary. This prohibition will protect the significant natural resources and qualities that are especially sensitive to potential impacts from outer continental shelf oil and gas activities. In particular, the sea otters, sea birds, and pinnipeds that use the haul-out sites, kelp forests, and rocks along the Olympic Peninsula and the Sanctuary's high water quality are especially vulnerable to oil and gas activities in the area. MMS rates the Washington/region planning area as the area of the continental U.S. (outside of Alaska) in the current Five Year Leasing Plan that is highest in rank on a broad index of marine productivity and environmental sensitivity. It has a higher environmental productivity and sensitivity ranking, and lower hydrocarbon potential, than the Monterey Bay, California Sanctuary planning area which was recently closed off to OCS oil and gas activities by Presidential Proclamation. A prohibition on oil and gas activities within the Sanctuary boundary will help protect Sanctuary resources and qualities.

This prohibition does not completely protect the Sanctuary from the potential impacts from oil and gas development. Development activities can occur south of the Sanctuary boundary, and if an accident were to occur during the winter months, the spill would be carried by the currents northward into the Sanctuary. NOAA will have some control over any future exploration or development activity through the Sanctuary prohibition on discharges that enter and injure Sanctuary resources from outside Sanctuary boundaries.

b. Consequences of Impact to Uses

NOAA's prohibition on oil and gas exploration and development within the Sanctuary boundary will eliminate the potential for increased noise and human activity in coastal and offshore waters. It will also eliminate the need for additional supply boats to enter the nearshore waters and overflights of helicopters that may incidentally approach nesting or resting marine mammals or birds. This prohibition will eliminate the development pressures on shore to support such activities.

Given the wealth of sensitive renewable natural resources within the proposed Sanctuary, the high tourism and commercial fishery value of the area, and the present indications of low national oil and gas resource potential, it is NOAA's judgement that the net economic effect resulting from a restriction on

hydrocarbon operations is most likely positive. The net economic effect of the regulation depends largely on the amount of hydrocarbon reserves foregone, dollar value of the oil, the estimated value of the renewable resources, and the economic value of the tourist industry.

NOAA believes that the regulation will have positive long-term economic impacts by contributing to the preservation and health of renewable sources of income, such as fishing and recreation, due to the long term protection of such activities from potential oil spills, discharges and visual and acoustical disturbance. In addition, the Sanctuary research and education programs would have long term benefits by enabling natural resource managers to make better informed decisions regarding the preservation, enhancement and possible additional economic benefits of the areas's natural resources and uses. This regulation will however eliminate any use of the area by the oil and gas industry.

Boundary alternative 4 encompasses an estimated 5% of the reserves estimated to be in former Lease Sale #132. Since the exploratory activities have been cursory, there is no accurate indication of the amount of oil and gas reserves within this Lease Block. Therefore, it is impossible to determine the exact economic impact of the prohibition on oil and gas development within the Sanctuary.

It is possible that the proposed prohibition would reduce U.S. Treasury income from offshore lease sales and leasing royalties. The total amount of lost revenue estimated by MMS from these conditional resource estimates may be modified by the results of petroleum development pursuant to actual drilling associated with some future Lease Sale, as well as an analysis of economic feasibility and environmental and regulatory constraints. Economic feasibility is determined solely by the oil industry based on lease sale costs at the time of sale, current oil prices, proposed project costs, and environmental reviews and mitigation costs. Oil development costs and expected returns per investment are considered confidential information by the oil industry. Once again, environmental and regulatory constraints are impossible to identify due to the lack of experience of the Washington/Oregon planning area with offshore oil and gas development.

C. Discharges or Deposits

1. Status Quo

a. Consequence of Impact to Resource

With increasing human uses in the ocean and adjacent watersheds, discharges and deposits into the proposed Sanctuary can be predicted to increase, further threatening the resources and qualities of the area, particularly in the coastal zone, and

human uses such as fishing and recreation that depend upon high water quality.

Under the status quo, discharges will continue to pressure the resources of the coastal zone. It is believed that the cumulative impacts of point and non-point source pollution has already begun affecting the quality of the kelp beds and benthic communities along the Strait and outer coast. Without a coordinated approach and goal for protecting the coastal resources, the impacts may continue to degrade under the pressure of coastal development.

i. Discharges from Point Sources

The Tribes receive their NPDES permits directly from EPA rather than obtaining them through the WDOE.

The only point source discharges from the U.S. along the outer coast and Strait of Juan de Fuca occur from Tribal treatment plants. The Makah and the Quileute Tribes are the only Tribes that are permitted by EPA to discharge wastewater into the marine environment. The Makah's have an inadequate sewage treatment plant and are in the process of upgrading their treatment system. Under consideration is restoration of an ocean outfall pipe which has not been in use for years, but is permitted by EPA. This ocean outfall would discharge into the Strait of Juan de Fuca sewage having received primary treatment. To rehabilitate the outfall would require a Clean Water Act (Section 301(h)) waiver from EPA. The Makah's are considering building a lagoon to treat their wastes which would achieve the equivalent of secondary treatment during peak season and tertiary treatment during the off season.

The Quileute Tribe have been plagued with costly mechanical failures and erosion of the drainage field which drains their treatment plant. They too are planning to upgrade their treatment plant.

ii. Non-Point Source Discharges

Non-point source discharges result mainly as a consequence of timber practices in the coastal drainage basins. There is anecdotal evidence that the kelp beds have been negatively impacted by increasing sedimentation over the past 20 years. The Pyscht River estuary, supporting the largest saltwater marsh in the Strait of Juan de Fuca, has experienced severe sedimentation which is degrading important juvenile salmonid habitat and is likely representative of other small estuarine environments adjacent to the boundaries of the study area.

iii. Hazardous waste, oil and trash disposal

There is an unknown quantity of pollutants and trash which

enters the Olympic Coast area from the open ocean. These discharges and deposits may have been transported far distances by ocean currents or may have come from vessels. In addition to reducing overall water quality and lessening the aesthetic appeal of the area, the discharge of litter may harm marine mammals that sometimes ingest or become entangled in such litter. In areas of the northern Pacific Ocean as many as 8,000 fur seals become entangled in such debris annually (Haley, 1978). The incidence of the mortality associated with this type of mammal disturbance remains unclear.

The MPPRCA of 1987 amends MARPOL, by prohibiting the disposal by ships of plastics, such as fishing lines and bags. This protects marine animals and seabirds from ingesting these wastes while foraging, or becoming entangled in them, possibly leading to illness or death. The MPPRCA regulations also prohibit, for example, the disposal by ships of paper, rags, glass, metal bottles, crockery and similar refuse less than 12 nautical miles from the nearest land; the disposal of dunnage lining and packing materials that float less than 25 nautical miles from the nearest land; and the disposal of victual waste less than 12 nautical miles from land (if ground, 3 nautical miles).

Discharges, such as cooling waters from boat engines and fish wastes, used in, or resulting from, fishing vessels during traditional fishing operations are unlikely to harm the resources of the Sanctuary. Discharges resulting from military activities in the area, such as smoke markers, sonobuoys and ordinance, are slight and do not appear to pose a threat to the resources and qualities of the proposed Sanctuary. In addition, Department of Defense vessels are required to be equipped with oil-water separators. The water effluent from these devises must meet standards of 20 parts per million (ppm) oil within 12 nautical miles from land, or 100 ppm beyond 12 nautical miles from land. The oil portion is retained on board for shore disposal.

iv. Ocean Dumping

Ocean dumping, municipal outfalls, and dredged material disposal can smother benthic biota and introduce substances into the marine environment, which may affect fish, bird, and mammal resources. However, all ocean dumping need not meet the standards established by Title I of the MPRSA.

Currently, the dredge disposal sites in Washington are located off Grays Harbor, Willapa Bay and the Columbia River. No dredge disposal sites are located north of Grays Harbor. There are plans to expand the marina at Neah Bay and dredge disposal is planned to be used for beach nourishment near the marina and disposed at upland sites.

b. Consequence of Impact to Uses

Most regulatory decisions pertaining to dischargers are determined on a case-by-case basis with the primary intent of facilitating the use rather than protecting the environment. The Juan de Fuca Canyon and important benthic habitats would not be given special consideration when deciding upon permits. Therefore from the Sanctuary's perspective, certain gaps remain in the regulatory framework.

2. Sanctuary Alternative (Preferred)

a. Consequence of Impact to Resources

The proposed final regulations prohibiting discharge or deposit of materials or other matter (with certain limited exceptions) without NOAA approval complements the existing regulatory system, and would enhance the area's overall recreational and aesthetic appeal, maintain the present good water quality in the Sanctuary, and help protect Sanctuary resources. By maintaining high water quality off the Olympic Peninsula and regulating discharge and deposit activities from an ecosystem-wide perspective the impact of this regulation is predicted to protect the resources and qualities of the Sanctuary above that of the status quo.

Although the Sanctuary would not be terminating any existing uses that discharge or deposit into the Sanctuary, it is expected that this discharge prohibition would have a positive impact on Sanctuary resources through the restriction and possible prohibition of future discharges that threaten the resources and qualities of the Sanctuary. By serving as the steward for Sanctuary resources, the Sanctuary intends to monitor the status of coastal resources and impacts from point and non-point source discharges. There is currently, no comprehensive protection and monitoring of those resources, despite the fact that they represent some of the most diverse and prolific intertidal and subtidal communities in the Pacific Northwest, and indeed, the world. Protection of these resources from point and non-point source discharges will ensure continued use of the resources for subsistence harvest, recreational diving, and recreational, commercial, and treaty fisheries. The Sanctuary program will coordinate with watershed management initiatives and agencies with management jurisdiction in the coastal watersheds to monitor and protect the coastal resources.

b. Consequence of Impact to Uses

The impact of these regulations is expected to be beneficial to the users of the Sanctuary. The requirement of Sanctuary review of permits for municipal outfall disposal ensures that these potentially harmful activities receive special consideration from the Sanctuary's perspective. The Sanctuary

will ensure the continued use from such activities as recreational diving, fishing, tourism, research, aquaculture and others that depend on high water quality.

Another positive effect of the regulations would be that by working within the existing regulatory process NOAA will provide and coordinate data from existing studies that can be used to make better informed management decisions by all agencies including the Sanctuary. For example, there are a few site-specific watershed planning initiatives that are underway on the Peninsula to minimize point source pollution in the coastal watersheds. Yet, because there is little or no monitoring of the coastal resources, it will be difficult to evaluate the effectiveness of watershed plans and the means by which to fine-tune them if necessary. NOAA can facilitate the process by coordinating these initiatives and helping to set standards for discharges that will ensure the future protection of the coastal resources.

Those that discharge into the Sanctuary would not be prohibited from, pursuant to existing permits, conducting their activities following designation. Discharges and deposits are subject to all prohibitions, restrictions and conditions validly imposed by any other authority of competent jurisdiction. NOAA may regulate the exercise of existing permits or other authorizations (but not terminate them) to achieve the purposes for which the Sanctuary was designated.

NOAA will also review applications for new permits and other authorizations. Applicants must provide timely notice of the filing of the applications and any additional information NOAA deems necessary. NOAA will either approve them, approve them with terms and conditions, or disapprove them to ensure Sanctuary resources and qualities are protected.

Activities conducted by Tribes pursuant to an existing treaty shall not be terminated by the Sanctuary program. Tribal activities authorized by an existing Treaty may only be regulated if all other possible alternatives have been exhausted with no resulting benefits to the resources, or in emergency situations.

NOAA intends to consult with scientific institutions and local, State and regional organizations, as well as with the holders of, or applicants for, any authorization or right and the relevant permitting authorities of these activities to determine means of achieving the Sanctuary purposes. If additional conditions are necessary, NOAA will work with the permittees and permitting authorities to determine the necessary level of conditions to provide adequate protection of Sanctuary resources. Procedures to ensure efficient administration of NOAA certification and other processes are explained in the proposed final Sanctuary regulations. In general, NOAA intends to work

with existing authorities to formalize the oversight and management role of the Sanctuary and increase Federal, state, tribal and local cooperative efforts to achieve the agencies mutual goals.

For example, the requirement of NOAA certification of existing permits for municipal sewage outfalls will ensure NOAA consideration of potential impacts on Sanctuary resources and qualities. The NOAA certification process will be coordinated with EPA, the state and tribal governments. NOAA approval of future permits for municipal sewage outfalls is necessary to exempt such outfalls from Sanctuary regulatory prohibitions. NOAA participation in the permitting process will ensure protection of Sanctuary resources and qualities.

The requirement for new permits of secondary treatment or greater, as necessary depending on the risk to Sanctuary resources and qualities, is expected to minimally impact the coastal economy. The Quileute Tribe is currently planning improvements to their wastewater treatment facility and the Makah are planning upgrades of their facility as well. Both are currently discharging primary treated effluents; however, their improvements are expected to attain secondary treatment.

In reviewing existing or future permits, licenses, approvals, or other authorizations, NOAA intends to encourage best available management practices to minimize non-point source pollution entering the Sanctuary. Sanctuary review of discharge activities will be done in coordination with EPA, the state and the tribes. No disposal sites may be permitted within the Sanctuary.

D. Historical Resources

1. Status Quo

a. Consequence of Impact to Resources

The most significant cultural resources are tribal areas of cultural and/or historical significance. The tribes have inventoried the sites that are significant. Many are rocks, paths, islands with burial grounds, etc.. that dot the entire Washington Coast. There have also been numerous shipwrecks along the coast, most have been a result of groundings on the offshore rocks. The wave energy, however, has resulted in the disintegration of most of the shipwrecks. There are records of shipwrecks further offshore but none have been excavated due to the low economic value of the cargo transported by these vessels, and the technical difficulty in accessing the shipwrecks. There is one shipwreck in 130 feet of water off Tongue Point in the Strait of Juan de Fuca which is a popular dive spot. The mast of this ship, located in 130 feet of water, reaches to a depth of 80 ft.

A recent MMS study of the geologic makeup of the offshore continental shelf indicates that there were probably human settlements along the submerged continental shelf dating back to the last glaciation. Studies using satellites and radar imagery are needed to locate artifacts submerged in the offshore continental shelf.

The Washington State Office of Archeology in the WDCD is responsible for maintaining an inventory of marine archeological resources in Washington State waters. The tribes are consulted during the permitting process for activities resulting in the excavation or disturbance of tribal archeological resources in state waters. Pursuant to the State Environmental Protection Act, the process for permitting research activities accounts for ecological impacts on the marine environment.

b. Consequence of Impact to Uses

Current activities will continue under the status quo without any special protection to historical sites beyond state waters There would be no special requirements for private sector uses such as treasure salvors and recreational divers or public sector agencies such as the Navy, to consider the historic value and ecological consequences of their uses from a Sanctuary perspective.

2. Sanctuary Alternative (Preferred)

a. Consequence of Impact to Resources

Historical resources are defined as resources possessing historical, cultural, archaeological or paleontological significance, including sites, structures, districts, and objects significantly associated with or representative of earlier people, cultures, human activities and events. Thus any inundated prehistoric aboriginal sites and associated artifacts, as well as shipwrecks would be included in the resource protection regime of the proposed Sanctuary.

This regulation is aimed at protecting historical resources NOAA's policy regarding historical resources is fairly congruent with existing state policy. NOAA intends to extend this policy to Federal waters. The regulations provide for the issuance of a NOAA permit for various reasons, e.g., research or to further salvage or recovery operations in connection with an abandoned shipwreck in the Sanctuary (title to which is held by Washington State).

NOAA will thus be able to ensure that all parties affecting historical resources within the Sanctuary conduct their activities according to recognized archeological procedures. NOAA will also be able to ensure that the activity is conducted consistent with the NHPA and that the proposed user consult with

the Washington State Historic Preservation Officer.

As part of the Sanctuary management regime NOAA intends to research the number and type of historical resources within the boundaries of the Sanctuary, building on the research of others in the area, and at other Sanctuary sites along the west coast. This research will further our understanding of human populations, their use of the marine environment, and how to protect these resources so that they are available to future generations.

NOAA will also seek National Register listing of appropriate identified resources located in the Sanctuary under the NHPA. Listing would make available grant and survey funds from the Secretary of the Interior (Heritage Conservation and Recreation Service) to be used to identify resource distributions and assess their significance. Placement on the National Register also ensures careful review of proposed Federal activities which could adversely affect identified resources. However, listing does not prevent removal or damage of the resource by non-Federal entities.

Historical resources in the marine environment are fragile, finite and non-renewable. This prohibition is designed to protect these resources so that they may be researched and information about their contents and type are made available to the public.

b. Consequence of Impact to Uses

The proposed final regulation is not likely to significantly affect existing activities within the Sanctuary. Users such as Navy salvage operations, recreational divers and treasure salvors would have to obtain a Sanctuary permit if their proposed activity would violate the Sanctuary prohibition.

The current management regime for excavating archeological resources allocates up to 10% of the value (economic value or artifacts) of an excavation after having an opportunity to examine all of the resources prior to falling into private ownership. The Sanctuary will require that the sanctuary program has access to all archeological resources for educational purposes, including those ultimately destined for personal possession pursuant to state law.

NOAA can also impose penalties of up to $100,000/violation for infractions of the Sanctuary regulation addressing historic/cultural resources. This regulation does not apply to moving, removing or injury to historical resources resulting incidentally from aquaculture or traditional fishing operations.

E. Alteration of, or Construction on the Seabed

1. Status Quo

a. Consequence of Impact to Resources

Currently, the only activities that involve altering or constructing on the seabed are the placement of hydroacoustic sonobouys and cable by the Navy within a 25 square nautical mile subsurface torpedo range off of Kalaloch. However, commercially valuable sand and gravel deposits off of Cape Flattery and the Quinault River have the potential of being commercially developed. This mining could potentially have severe impacts on the benthic environment disrupting habitat for the valuable crab and groundfish fisheries, and gray whale foraging areas (Table 8).

b. Consequence of Impacts to Uses

The status quo will allow dump sites to be established within the Sanctuary pursuant to EPA and COE permits. Also, gravel deposits will be available for development. These activities will be pursued without protection from a Sanctuary perspective.

2. Sanctuary Alternative (Preferred)

a. Consequence of Impact to Resources

The Sanctuary prohibition on alteration of, or construction on the seabed will ensure the continued integrity of the benthic habitat which is critical to the support the marine fish, mammal and seabird populations. Effects of marine mining include emissions of gaseous or particulate matter to the atmosphere, changes in water quality such as red tides, increased turbidity, and storm induced slides, major geologic impacts in the coastal zone where wave energy is a dominant force, changes in current patterns inducing erosion or deposition, and introduction of new habitats which may cause the loss of feeding areas for marine mammals and other organisms in the food web.

b. Consequence of Impact to Uses

The Sanctuary regulation ensures that the integrity of the entire ecosystem of the Sanctuary does not degrade through the cumulative impacts of development projects. These impacts threaten to diminish the value of the region for fisheries, recreation, wildlife, and spiritual benefits.

Currently, dredging of harbors within the preferred boundary (La Push and Neah Bay) occurs rarely and clean dredge spoils are deposited to renourish beaches and stabilize jetties. These harbor maintenance activities will not be impacted by the Sanctuary since harbors are excluded from sanctuary boundaries. The planned expansion of the marina at Neah Bay will necessitate

Table 8. Summary of Environmental Effects of Marine Mining by Resources Affected (MMS, 1993).

Resource and Environment	Significant Findings	Salient References*
AIR QUALITY	Emissions of gaseous or particulate matter to the atmosphere are of greatest potential concern. Principle emissions are nitrous oxides and residual (reactive) organic compounds. During exploration and test mining, emissions are expected to have little effect on onshore air quality except offshore California where high background pollution already exists. Emissions from marine mining sources are expected to be qualitatively and quantitatively similar to oil and gas related sources. In the deep ocean, some gases might be released from seawater brought to the surface from the seabed via hydraulic dredging; information on this effect is sparse. Noise from non-explosive seismic exploration activity is generally dismissed as insignificant. In terms of global or regional effects of marine mining, there is only limited literature on this subject. Effects are generally examined on a site-specific level. No significant problems or priority areas for research are noted.	USDOI, MMS (1988b) OTEC publications
WATER QUALITY		
Natural Effects	In general, the natural effects of environmental change are easily recognized. Phenomena such as red tides, mega-plumes resulting from seabed hydrothermal activity, and storm- or earthquake-induced slides may result in significant but temporary changes in water quality.	
Induced Effects	Induced effects (e.g., turbidity, nutrient or trace metal enrichment) may result in secondary effects throughout the trophic web.	
Deep Ocean and OCS	Impacts are difficult to assess. The capacity for assimilation of plumes increases in deep water, however other factors (e.g., presence of a thermocline, low velocity benthic currents) may prolong the effects of plumes compared to shallow coastal waters. Effects should be examined on a site-specific basis. Dilution of a discharge to low concentrations is rapid (i.e., reduced to 1,000 ppm within 2 min of discharge; to 10 ppm within 1 h). The affected zone typically extends 1,000 to 2,000 m down current. Field studies of drilling muds and other discharges indicate that pollutants are rapidly reduced to background levels. Long-term, chronic effects of these discharges have not been observed. Mining discharges are subject to the same settling and dilution factors as oil and gas related discharges. Turbidity from resuspended sediments may be detected down current over many km; direct effects and indirect effects (e.g., nutrient or trace metal enrichment, increased biological or chemical oxygen demand) are limited to the immediate area of operations. Petroleum spills from marine mining activities would be limited to fuels (during transfer) and tanker loss.	Aurand and Mamontov (1982) Cruickshank et al. (1987) de Groot (1979b) Drinnan and Bliss (1986) ECOMAR (1983) Evans et al. (1982) Gillie and Kirk (1980) Hirsch et al. (1978) Middleditch (1981) Neff (1981, 1985) U.S. Congress, Office of Technol. Assess. (1987) Zippin (1988)
Coastal and Onshore	Marine mining would affect water circulation and water quality proportionally to the level of activity. Large stockpiles of marine minerals or mining wastes could be usefully maintained or disposed of at convenient sites near to shore; impacts from these activities can only be assessed by analysis of site-specific conditions. The shallow and confined nature of many coastal waters makes them susceptible to perturbation or pollutants. Turbidity is generally not considered a problem (e.g., sand and gravel mining operations are discontinuous; deposits rarely contain large amounts of silt-sized material). Good management practices are critical to eliminate potential impacts. A very low potential exists for release of chemicals normally associated with harbor and channel dredging (e.g., PCBs, trace metals).	U.S. Congress, Office of Technol. Assess. (1987)

Resource and Environment	Significant Findings	Salient References*
Terrestrial Sites	Impacts on water quality at shoreside facilities are attributed to gaseous, liquid, or solid waste emissions. Potentially serious problems include the dumping of mined tailings and processing wastes into adjacent waterways. The nature of the effect will be influenced by the characteristics of the dumped material, the nature of the waterway, and its ecosystem.	Ellis (1987, 1988, 1989) Ellis and Hoover (1990)
GEOLOGICAL RESOURCES	The primary effect is the removal of the ore; additional secondary effects may include alteration of the value of remaining mineral resources (grade depletion) and alteration of the seabed.	
Mineral	Mineral deposits removed by mining result in an irretrievable transfer of the mineral from a resource base to a consumptive use.	
Other	Major geologic impacts of marine mining result from activities in the coastal zone where wave energy is a prime factor. The effects of large excavations or shoaling resulting, for example, from the mining of mineral sands will depend on location. Changes in wave or current patterns induced by altered conditions can cause changes in shoreline equilibrium, causing erosion or deposition. Possible effects from sub-seabed fracturing using conventional or other type explosives are not well discussed in the literature; additional study and observation (i.e., in offshore areas susceptible to slumping, in deep water) was suggested. Coral reef growth may be severely affected by siltation, altering the supply of coral sands to adjacent beaches.	Chansang (1988)
BIOLOGICAL RESOURCES	Most biological impacts are secondary, attributed to some alteration in existing physical, chemical, or trophic equilibria. Impacts in the coastal zone have a greater tendency to be significant because of higher energy levels. Physical changes which may induce biological effects include changes in temperature, current patterns, amount of particulates present, nature of the substrate, and introduction of new habitats. Significant chemical changes include changes in the presence of nutrients, trace elements, or toxics. Trophic changes include removal or alteration of indigenous species. Biological impacts are the major enigma of impact assessment. Criteria upon which significant biological changes are based are typically arbitrary. Generalizations rarely allow meaningful prediction of the effects of specific mining operations. Biological studies should be directed on a case-by-case basis to respond to specific needs. Effects of turbidity, sedimentation, explosives, light, and noise on marine biota have been reviewed. Other data sources were noted from deep seabed mining, OCS oil and gas, and academic research.	Cruickshank et al. (1987)
Birds	Large oil spills which have the potential to kill numerous sea birds and shore birds are not anticipated from marine mining operations. Effects of small spills tend to be localized and short-lived.	USDOI, MMS (1983b, 1991)
Mammals	Effects of operations may include loss of feeding areas, uptake of heavy metals, and noise. Oil spills are not considered significant because of the low risk. Mining activities located away from known migratory pathways and calving or feeding grounds are unlikely to adversely affect marine mammal populations although individual transient animals near mining sites may be startled or show avoidance behavior. Limited research suggests habituation to low-level noise.	Gales (1982) Geraci and St. Aubin (1980) USDOC, NOAA (1981) USDOI, MMS (1983a,b)

Resource and Environment	Significant Findings	Salient References*
Marine and Aquatic Fauna	Both adverse and beneficial impacts have been noted. Beneficial impacts include the attraction of fish to offshore structures; enhancement of substrate habitats by alteration of the texture; enhancement of substrate habitats by the presentation of new surface nutrients by mixing and replacement of the benthos; thermal stimulation of growth; and introduction of nutrients by mixing of water masses and enhancement of phytoplankton growth. Adverse effects include direct lethal toxic effects (e.g., abnormal growth, reduced adult fecundity, behavioral changes, etc.) and disruption of community and ecosystem structure (e.g., changes in diversity and abundance via food web disruption, changes in predator-prey relationships, etc.). Analyses of potential impacts requires a knowledge of the pre-operating populations and their natural cycles, allowing a differentiation between natural fluctuations and impact response. Adequate knowledge of pre-operating conditions (baseline) is debatable. Difficulties arise in the selection of indicator species. Effects of marine mining operations occur from turbidity, smothering, and pollutants (from mined formations). Turbidity effects may not be a concern if dilution rates are high and sensitive communities are not proximal to the mining site. Numerous studies have been conducted regarding the effects of turbidity on indigenous fauna, especially fishes. The exposure of free-floating organisms (e.g., plankton) to high turbidity concentrations will be limited. Turbidity impacts from aggregate dredging operations on sensitive benthic organisms will be far less than placer mining. Smothering of bottom dwelling organisms is due to the settlement of suspended sediments and associated depletion of oxygen in surrounding waters. Coral reefs and seagrass beds are particularly sensitive. Smothering is perceived as being of greatest concern in placer mining operations. Pollutants may affect growth and reproductive rates. The effects of pollutants on the physiology of marine fauna has received only limited study. Effects on marine phytoplankton are observed in response to decreased illumination in the laboratory, but these shading effects are not expected to be a problem in open waters. In the benthos, some species will likely be more affected than others because of feeding mode (filter feeders), life habit (surface dwellers), degree of mobility (tube dwellers), or sensitivity of life stage (larvae). Areas that may not be able to withstand slight increases in sediment deposition include coral reefs and areas used by bottom spawning fish. In cases where a majority of the benthic community has been adversely affected, recolonization will occur from populations outside the disturbed area. Benthic organisms may serve as indicators of pollutants and the structure of the benthic community may be indicative of a stressed or disturbed environment.	Aurand and Mamontov (1982) Bigham et al. (1982) Blaxter (1980) California Department of Fish and Game (1977) Chan and Anderson (1981) Clark (1988) Cressard (1981) Cressard and Augris (1982) Cruickshank (1974a,b; 1987) Dawson (1984) de Groot (1979a,b) Drinnan and Bliss (1986) Ellis and Hoover (1990) Gillie and Kirk (1980) Glasby (1985) Hanson et al. (1982) Hirota (1981) Hu (1981) ICES (1979) Kawamura and Hara (1980) Levin (1984) Lunz et al. (1984) Matsumoto (1984) NRC (1985) Pfitzenmeyer (1970) U.S. Army Engineer District (1974) U.S. Congress, Office of Technol. Assess. (1987) United Nations (1981) USDOC, NOAA (1981) USDOI, MMS (1988b)
Flora	Effects on flora are not regarded as a major concern.	
Sensitive Habitats	In sensitive areas (e.g., Arctic waters), particularly in shallow water, or in the deep seabeds, slow regrowth of affected communities is expected. Areas of hydrothermal venting along mid-ocean ridge crests support unusual benthic colonies. Draft regulations have provided for avoidance of such environments.	Dunton et al. (1982) USDOC, NOAA (1981) USDOI, MMS (1983a)

Resource and Environment	Significant Findings	Salient References[a]
Threatened and Endangered Species	Impacts were discussed under respective biotic resource categories. Impacts are associated with noise (marine mammals, birds), accidental oil or fuel spills, and increased turbidity.	
SOCIAL AND ECONOMIC RESOURCES	Most actions resulting in environmental query are triggered on the basis of some social or economic need. Such aspects are built into the scoping process for respective environmental documents. The literature is voluminous and scattered.	
Human Resources	Effects on human resources include health, employment, and infrastructural needs. For processing plants and mining operations conducted from platforms or seabed mining operations carried out in the hard rock, extended periods of relative isolation create impacts on mining personnel. The social environment is extremely variable and widely described, but not specifically for marine mining. Disturbances must be weighed against benefits. The ranking of multiple uses is potentially highly subjective. From a legal perspective, national laws are not adequate for many minerals and international laws regarding the mining of the seafloor are still not well-defined. In many instances, national and international laws have lagged behind rapid social change. Several aspects have a significant effect on planning and conduct of operations, including the exhaustible nature of mineral resources, resource conservation, and multiple uses of mineralized areas.	USDOI, MMS (1988a,b)
Commercial and Recreational Fisheries	Literature from Europe is more extensive on this subject than in the U.S. Modern European prospecting operations cause little disturbance to the marine environment and do not interfere with other activities at sea; no formal government consultations procedure exists for a prospecting license, however, the permitting process is substantive. As a resource, standing fishery stocks are affected by various factors (e.g., turbidity, pollutant loading, physical disturbance). Direct effects of oil or turbidity are limited due to the mobility of fish. Indirect effects include damage to eggs, larvae, and juveniles; sublethal uptake of hydrocarbons and pollutants; loss of prey; loss of habitat; and reduced reproductive success. Marine mineral activities may interfere with fishing activities and compete for space at sea and in port. Space use conflicts between fishermen and vessel operators have occurred with entanglement or severing of net and trap lines. Coordination efforts between the two industries have helped avoid most vessel conflicts. Recent research interest has included assessment of the potential for marine geophysical surveys to reduce catchability of fish and damage to fish eggs and larvae. Long duration, spatially concentrated use of seismic energy sources can disturb the spatial distribution of fish in the water column and reduce catchability. It is expected that there has been some loss of individual income through lost catch opportunity or gear loss and increased cost of port space.	Nunny and Chillingworth (1986) Pasho (1986) Zippin (1988)
Regional Economies	Impacts from resource disturbance will be measurable on the economy. The extent of the economic impact resulting from a given action is affected by various factors. A determination of a prospect's feasibility must consider the net rate of return on the investment.	Sorensen and Mead (1969)
Local Economies	Local economies are site-specific, driven by many factors.	

Table ES2.2 (Continued)

Resource and Environment	Significant Findings	Salient References*
Cultural Resources	Effects are particularly difficult to quantify because intangible cultural systems are subject to the historical and contemporary changes induced by all human activities. A comparison of alternatives using semi-quantitative methods of factor analysis might be valid. Archeological resources may be significant and should be protected.	Cruickshank (1974a)
Technical Resources	Major impacts on technology appear in the form of disturbances to the system due to materials failure primarily effected by motion, pressure, corrosion, and biological fouling. Impacts on the environment are relatively small.	

* - Salient references indicate key sources; several reference listings (e.g., Marine and Aquatic Fauna) have been pared, given tabular space constraints.

the disposal of dredged material outside sanctuary boundaries. Inside the Sanctuary, activities associated with harbor maintenance including the installation of navigation aids are exempted from the Sanctuary regulatory prohibition. The Sanctuary program is supportive of the marina expansion and will work with the Makah Tribe to pursue appropriate disposal alternatives. The Makah Tribe plans to use the dredge spoil for beach nourishment and upland projects.

Commercial mining of sand and gravel deposits off the coast is prohibited within the Sanctuary. This prevents the public from receiving economic benefits from these potential commercial endeavors.

The regulation prohibits placement of any structure or other matter on the seabed, such as, but not limited to, artificial reefs, pipelines and outfalls, unless relevant permits are reviewed and certified or approved by NOAA. The prohibition also includes placement or abandonment of any structure or other matter on the seabed, which includes vessels that run aground. This helps ensure that owners and operators are responsible for the removal of their vessels.

The activities exempted from this regulation would be monitored by the Sanctuary manager, based on information supplied by the EPA, COE and the WDNR. If the data collected demonstrate that a greater degree of Sanctuary oversight is appropriate, amendments to the regulations could be proposed.

F. Taking Marine Mammals, Turtles and Seabirds

1. Status Quo

a. Consequences of Impact to Resources

The current regulatory regime under the U.S. Departments of the Interior and Commerce gives each Department the authority to designate and protect oceanic habitats if found to be "critical" for species listed as "endangered" under the ESA (ESA). The MMPA and the ESA prohibit the "taking" of marine mammals and threatened or endangered species. The MBTA prohibits the taking, killing, possessing, selling and other specified forms of exploitation or migratory birds. The term "taking" is defined broadly under the ESA and MMPA and has been interpreted by the administering agencies, so that the ESA and MMPA provide considerable protection. However, the potential threats to marine mammals and endangered species range from direct injuries to a specific animal or population to indirect or cumulative degradation of their habitats. Neither the MMPA nor the ESA fully prevent such degradation of habitats. Section 7(a) of the ESA does provide protection against actions which jeopardize endangered species or their critical habitats, but this section applies only to activities authorized, funded or carried out by Federal agencies, not to private or state actions. There is no

explicit provision for the designation or protection of marine mammal habitats under the MMPA. Thus the MMPA, ESA and MBTA together provide considerable protection to the marine mammals, turtles and seabirds of the Sanctuary by prohibiting the taking of specific species protected under those acts, but fail to focus particular attention on the habitats of the species covered by the Acts.

Further, no Federal authority currently exists to identify and protect localized marine habitats of exceptional importance to non-endangered species. While the MMPA and the MBTA proscribe the hunting and taking of marine mammals and migratory birds, they do not protect their habitats from potentially adverse uses. Such program deficiencies have left certain valuable marine habitats largely unprotected. If current uses intensify and seriously threaten resources, the lack of suitable management authority to intervene could allow undesirable environmental impacts to the seabirds, marine mammals and turtles of the area.

b. Consequence of Impact to Uses

Currently the status quo addresses the taking of marine mammals and seabirds under relevant legislation. Marine mammals (except sea otters) may be taken incidentally to commercial fishing pursuant to 16 U.S.C. 1383a until October 1993, after which rulemaking pursuant to 16 U.S.C. 1371, 1373 and 1374 may be required. Fishing activities that potentially take marine mammals are required to have observers and/or logbooks on board to monitor the extent of takings. Researchers studying marine mammals are required under the MMPA to obtain a permit for their activities.

2. Sanctuary Alternative (Preferred)

a. Consequence of Impact to Resources

The proposed regulation would overlap with the MMPA, MBTA and ESA, extending protection consistent with the intent of the MPRSA to protect the Sanctuary resources on an environmentally holistic basis. The proposed regulation would include all marine mammals, sea turtles and seabirds in or above the Sanctuary. The Sanctuary regulation would also allow for the imposition of greater penalties, i.e., $100,000 per violation.

b. Consequence of Impact to Uses

The regulation would not preclude a number of current activities from continuing. For example, scientific research on marine mammals and seabirds that are Sanctuary resources is encouraged as part of the Sanctuary mandate. To facilitate this research the proposed final regulations allow the issuance of Sanctuary permits for research. If the research is on Federal or state designated endangered species or on marine mammals, the

researchers are already required to obtain permits from the relevant management agency and would not have to obtain a Sanctuary permit or other approval under the proposed final regulation.

As another example, NOAA will work with existing fisheries management agencies as well as National and local fishery organizations including the PFMC to ensure that the incidental taking of seabirds, sea turtles and marine mammals in commercial fishing nets is minimized.

Finally, rehabilitation of injured seabirds, and studies on dead seabirds and marine mammals, would be permitted under these Sanctuary regulations in response to an emergency threatening life, property, or the environment or pursuant to a research permit.

G. Overflights

1. Status Quo

a. Consequence of Impact to Resources

There are a few small airports and landing strips along the coastal portions of the Sanctuary including a beach landing strip at Copalis, an unstaffed airport at Quileute, an airport at Sekiu and one at Port Angeles. Most of the airplanes utilizing these airports are recreational aircraft or airtaxis. There is a cargo plane that lands daily at Quileute Monday through Friday. Airtaxis to Sekiu are used largely to taxi sports fishermen to Neah Bay for recreational fishing excursions. A radar tower on the peninsula monitors air traffic above 3000 feet above ground level (AGL). A military operating area extends over the Olympic Peninsula and Sanctuary waters above 1200 feet AGL. When in use, other planes must stay below this altitude.

Over Sanctuary waters, there are no restrictions on aircraft with respect to the altitude they may fly. There is a 2000 ft. advisory over the Olympic National Park and USFWS offshore refuges. Most aircraft are believed to observe these advisories, but compliance is not mandatory.

Low flying aircraft threaten the safety of the seabirds and mammals that use the offshore islands and coastal habitats. The noise startles birds and mammals resulting in egg destruction, vulnerability of chicks to predation by raptors and gulls, and stampedes of pinnipeds causing the crushing of young mammals.

b. Consequence of Impact to Use

Although only a few charter airplanes fly over the Sanctuary, the uses may intensify as tourism increases potentially as a result of the expansion of the Neah Bay marina and the presence of the marine Sanctuary.

2. Sanctuary Alternative (Preferred)

a. Consequence of Impact to Resources

This prohibition is intended to protect marine birds and mammals from the disturbance and harassment of low-flying aircraft and to be consistent with the FAA's 2000 ft. advisory adjacent over protected areas adjacent to the Sanctuary.

b. Consequence of Impact to Uses

This regulation will require aircraft to remain above 2000 feet AGL within one mile seaward of the coastal boundary of the Sanctuary unless responding to an emergency threatening life, property, or the environment or necessary for valid law enforcement purposes. Department of Defense practice bombing of Sealion Rock will be prohibited from March 1 through October 31. Helicopters involved in timbering operations on tribal lands, and transporting researchers and tribal members to tribal lands will be exempted from this prohibition as well to be consistent with treaty-secured rights of access of tribal members to tribal lands.

Aircraft flying below 2000 ft. within the regulated zones for research purposes would need to obtain a Sanctuary research permit. The application would be processed expeditiously to ensure that while Sanctuary resources and qualities are protected, there would only be a minimal administrative burden on the applicant.

H. Vessel Traffic

1. Status Quo (Preferred)

a. Impact to Resources

With the projected increasing number of vessels approaching the Strait of Juan de Fuca (see Part II) it is likely that there will be a vessel related accident. Such an event, either by collision or grounding due to loss of power or steering control or human error would likely result in a spill of hazardous material. The rocky intertidal areas and the productive food chain off the Pacific coast are extremely sensitive to damage from oil or other pollutants. This is an area with little coastal access, and most booms are ineffective during common winter storms.

The implementation of an ATBA will offer significantly increased levels of protection by building in a safety net of time to allow emergency response vessels to respond to an emergency off the outer coast.

b. Impact to Uses

NOAA will rely on the existing management regime to manage

vessel traffic rather than promulgate regulations. However, NOAA will work closely with the USCG, the Washington State OMS and the vessel traffic industry on matters relating to vessel traffic through the Sanctuary. Vessel traffic will remain in the scope of the Sanctuary's regulations.

There is a Coordinated Vessel Traffic Management System in the Strait of Juan de Fuca with designated inbound and outbound lanes on the U.S. and Canadian sides of the international border, respectively. No vessel greater than 125,000 dead weight tons may pass east of Port Angeles and all vessels greater than 300 gross tons passing into Puget Sound must be accompanied by a pilot. All tankers must be accompanied by one (and soon to be two) escort tugs.

Outside of the Strait of Juan de Fuca there are voluntary agreements by maritime associations to coordinate the movement of coastwise vessel and barge traffic. Under these agreements, tankers transiting along the coast remain at least 50 nautical miles from shore unless entering a port of call. Barges follow agreed upon lanes within 5 and 10 miles from shore pursuant to the crabber-tugboat agreements negotiated yearly. The future of these agreed upon lanes, however, is uncertain.

There are no tugs specifically dedicated for emergency response in Puget Sound, the Strait of Juan de Fuca or Grays Harbor. There have been a number of near misses when vessels have lost power either off the coast or in the Straits. Likewise, there have been collisions off the Strait of Juan de Fuca (Tenyo Maru in 1991) and barges holed/damaged off the coast (Nestucca, 1988). However, the Strait of Juan de Fuca Emergency Towing Vessel Task Force has been formed and is charged with the mission of establishing, maintaining, and operating an emergency towing vessel in the Strait of Juan de Fuca.

NOAA has worked with the USCG and maritime industries in Washington State to analyze the time it would take for a vessel or barge travelling along the outer coast to ground once power was lost. This analysis was used to recommend preventative measures to minimize the chance of a spill of hazardous material. Following is the analysis upon which NOAA has recommended a strategy for addressing the risks presented by vessel traffic in the Sanctuary.

ANALYSIS OF VESSEL/BARGE BUFFER AREA OFF THE NORTHERN WASHINGTON COAST

The following are three actual incidents that occurred in Washington state waters. Two resulted in spills of contaminants. While the third did not result in a spill, it illustrates that response time is critical in order to avert an accident.

1. On December 22, 1988 the barge Nestucca was struck and punctured by its tug, the Ocean Service while attempting to retrieve the barge following the parting of the towline. The barge released 231,000 gallons of fuel oil into Grays Harbor and the surrounding coastal waters, polluting the coastline from Grays Harbor to as far north as Vancouver Island.

2. In January, 1972 the General M.C. Meigs broke free from its tow during a winter storm and went adrift approximately 9.5 nautical miles (nm) west of Cape Flattery. The tug was unable to retrieve the ship. Eight hours later, the ship grounded near Portage Head, just south of Cape Flattery. The incident resulted in a major oil spill.

3. A recent near-miss was reported by The USCG's Puget Sound Vessel Traffic Service (PSVTS) as follows:

"A 13,946 DWT tanker, loaded with caustic soda and other chemicals, lost all power off Cape Flattery and requested immediate assistance. Within minutes, PSVTS located the nearest lite tugs, and had them underway to the scene at top speed. PSVTS kept local, national, and Canadian interests informed with real time information throughout the incident. The tanker was retrieved and towed safely to anchorage for repairs."

What follows is a hypothetical scenario describing a maritime emergency off the western Washington coast. Its purpose is to assess current emergency response capability to a drifting barge or a disabled and drifting vessel in waters along the western Washington coast.

This scenario was developed by a former commanding officer after consultation with members of the commercial towing community, local meteorologists and weather forecasters, members of the USCG and the United States Navy, and personnel with experience in oil spill trajectory analysis. It graphically depicts the fact that response time is critical in the event of a maritime emergency.

Estimates for times of arrival of assistance tugs were obtained from the Emergency Response subcommittee of the Strait of Juan de Fuca/Northern Puget Sound Regional Marine Safety Committee.

The meteorological conditions described in the scenario could occur at any time during the period October through March. This specific scenario was developed by a veteran forecaster from NOAA's National Weather Service Forecast Office in Seattle, Washington.

The United States Coast Pilot for the Pacific Coast: California, Oregon, Washington, and Hawaii (26th edition) makes

the following note about weather in the vicinity of the western Washington coast near La Push, WA: "In the late fall and winter, the low pressure center in the Gulf of Alaska intensifies and is of major importance in controlling weather systems entering the Pacific Northwest. At this season of the year, storm systems crossing the Pacific follow a more S path striking the coast at frequent intervals... Gale force winds are not unusual."

The hypothetical incident involves a tug and petroleum barge on a December transit from a refinery in Anacortes to a port on the Columbia River. During this month, the following average weather can be expected (Director, Naval Oceanography and Meteorology, 1976):

1) Visibility of less than 1 nm along the Washington coast can be expected for approximately 1.7% of the time or 0.5 days.

2) Winds in excess of 34 knots (kts) can be expected for approximately 7.7% of the time or 2.4 days.

3) A westerly wind component with an average speed of 18 kts can be expected for approximately 10% of the time or 3.1 days.

4) Wave heights averaging 10-12 feet can be expected for 11.9% of the time or 3.7 days.

5) A current with an average speed of 1.0 knot setting to the north along shore can also be expected.

These are average conditions. In severe conditions, sustained winds in excess of 40-45 kts can be expected with accompanying seas of over 20-25 feet (U.S. Department of Commerce, 1990).

THE SCENARIO

Wednesday A.M (1000 Local Mean Time (LMT))

The ocean-going, twin-screw tug, North Wind (fictitious name) has just taken in tow a petroleum barge loaded with 30,000 barrels of Marine fuel oil. The tug and tow are bound from Anacortes to a port on the Columbia River. Anticipated speed over ground is 8.0 kts. Estimated time of arrival at the Columbia River bar is approximately 30 hours.

Current weather is moderate. A slight chop covers Puget Sound and the Strait of Juan de Fuca. Visibility is 3-4 nm. The sky is overcast with occasional drizzle. Winds in the Strait are easterly at 10-15 kts. The forecast is for an offshore, deepening 1000 Millibar (Mb) low pressure system to move onto

northern Vancouver Island during the next 24 to 36 hours. Winds along the western Washington coast are currently SE at 15-20 kts. Seas are reported 6-8 feet and building due to the approaching storm.

The captain of the tug considers all factors and decides he can clear Cape Flattery and be well southbound before the system comes ashore. Further, he concludes that conditions at the mouth of the Columbia River in 30 hours will be moderate enough to safely cross the bar upon arrival.

The tug and tow clear Anacortes and proceed outbound.

Wednesday P.M. (2200 LMT)

Twelve hours after departure from Anacortes, North Wind and its barge round buoy "J" at the entrance to the Strait of Juan de Fuca. The trip through the Strait has been uneventful. The weather, however, has begun to deteriorate. The barometer is falling. Wind speed is now a steady 20-25 kts SSE with occasional gusts to 30-35 kts. Wave height is increasing rapidly with the increasing wind.

To save time and in an attempt to beat the approaching system, North Wind takes up a southbound course using the published "Towboat-Crabber" traffic lane. This lane is a north/south route passing approximately 7 nm west of Cape Alava.

Although the North Wind's parent company has established a policy of voluntary adherence to a trackline 10-30 nm offshore when towing a loaded petroleum barge, this practice will not be followed today due to unfavorable weather conditions offshore. Further, due to sea state and wind being encountered, North Wind slows to 6 kts to reduce the beating on both tug and tow.

Thursday A.M. (0230 LMT)

North Wind's position is approximately 6-7 nm SW of Cape Alava, in the "Towboat-Crabber Lane," proceeding southbound. NOAA weather radio reports that the low pressure system is still moving toward Vancouver Island but is "rapidly deepening" at a rate of 1 Mb/hour. Pressure at the center of the low is now 980 Mb. Frontal passage is expected shortly. Winds are steady SSE at 30 kts with gusts to 40 kts. Seas are 12-15 and building. The barometer is falling. North Wind slows to 4.0 kts.

Thursday A.M. (0300 LMT)

With the front rapidly approaching the coast, winds accelerate to SSE 50 kts, with gusts to 65 kts. Seas are now 20 feet with some exceeding 30 feet. During a period of

exceptionally high sea and swell combinations, the towline parts. The petroleum barge is now adrift. Recognizing the danger, the captain notifies the Coast Guard of the situation and begins attempts to recover the barge.

After frontal passage, the wind begins veering to SW 30 kts with gusts to 50 kts. The result is a confused sea with 20 foot swells from the SSE and building 15 foot waves from the SW. The barge is drifting generally NE at approximately 0.9 kts (USCG, 1991a).

Initial efforts at recovering the barge are thwarted by the fact that the insurance wire (an emergency pick up line) from the barge is fouled and laying along the lee side of the barge.

The tug begins attempts to retrieve the tow by using the emergency barge retrieval system (a second backup retrieval device). During one attempt at retrieval, the tug passes too close to the barge and a collision occurs. The North Wind sustains damage to its hull and begins taking water in its engine room. On further inspection, one rudder is also found to be damaged. No further attempts can be made at retrieving the barge and the crew begins efforts to control the flooding and repair the rudder.

Thursday A.M. (0400 LMT)

North Wind immediately issues a Mayday call and notifies the Coast Guard that she is drifting and taking on water. The captain reports that he will be able to control the flooding and remain afloat. However, the petroleum barge is adrift and North Wind will be unable to regain control of it. In the darkness, with high winds and seas and poor visibility, the tug loses sight of the barge and is no longer able to identify it on the radar screen among the sea and rain clutter. The barge is, in effect, lost.

There are no vessels of opportunity in the area able to respond to the Mayday call. The Coast Guard initiates a search and rescue operation but has no vessels capable of taking either the tug or barge under tow. There are, however, two tugs in Anacortes. The Mayday call has been relayed to them and they have notified the Coast Guard and North Wind that they will respond. A smaller, twin screw tug in Grays Harbor has also heard the call and will respond.

Thursday A.M. (0500 LMT)

The responding tugs from Anacortes were conducting a docking evolution but concluded operations within an hour and were underway at 0500 LMT to render assistance. Estimated time of arrival at buoy "J" is 1300 LMT. Arrival on scene is estimated

to be 1500 LMT, Thursday afternoon - 12 hours after the incident.

The tug from Grays Harbor was also underway within an hour but will only be able to make 8-10 kts in the heavy weather. Estimated time of arrival for the Grays Harbor tug is between 1330 - 1400 LMT. The forecast for the scene at time of arrival of the responding tugs is for westerly winds at approximately 20 kts with gusts to 30 kts.

The tug and barge began drifting while approximately 6.5 nm WSW of Cape Alava. The tug is able to maintain steerageway and hold position but is still taking on water. The barge, however, is being affected by the wind (i.e., drift downwind at 3% of the wind speed) and a 1.0 kt (approximate) northerly current (Director, Naval Oceanography and Meteorology, 1976).

Although conditions aboard the North Wind are uncomfortable, the crew is making repairs, staying ahead of the water and the tug is not in danger of foundering. Due to sea state, wind, visibility, and low ceiling, the Coast Guard decides that the safest course of action to preserve human life will be for its rescue vessels to remain on scene and also attempt to locate the drifting barge. Coast Guard helicopters and rescue vessels will, however, react immediately should rescue of the tug's personnel be required.

The petroleum barge continues to drift. The responding tugs are 8.5-10 hours away. Using data obtained from Landry and Hickey (1989) to predict the combined effects of wind and current, personnel from NOAA's Office of Ocean Resources Conservation and Assessment in Seattle estimate that the barge will probably ground in the area of Waatch Point in 6-7 hours (1000 LMT). The barge, however, could go aground near Portage Head in 4 hours (0700 LMT) or near Cape Flattery in 8 hours (1100 LMT) due to local variations in wind and current.

Thursday P.M. (1400-1500 LMT)

Responding tugs arrive on scene. North Wind is taken in tow. The barge is aground and breaking up. Over 30,000 barrels of marine fuel oil are now at risk of being spilled.

SUMMARY AND ANALYSIS

As noted earlier in this FEIS/MP there are now no specifically designated emergency response towing vessels in the Strait of Juan de Fuca, along the western Washington coast, or in Puget Sound. There are several major towing and salvage companies in this area but, in the event of an emergency that requires towing, time of response would be based on both vessel availability and distance from the scene of the incident. Emergency response could be significantly delayed due to prior

assignment of response vessels to other towing, docking, or salvage operations, or the remote location of an incident or emergency from available vessels (Knight, 1992). Further, severe weather might prevent an emergency response vessel from leaving the Strait of Juan de Fuca or, if it did, prevent operations from commencing when it arrived on scene.

In a separate scenario developed by members of the Strait of Juan de Fuca/North Puget Sound Regional Marine Safety Committee, vessels responding to an emergency near the entrance of the Strait of Juan de Fuca would depart from Cherry Point, approximately 2.5 nm north of Lummi Bay. From there, they estimated it would take approximately 8 to 9 hours to reach Buoy "J" at the entrance to the Strait of Juan de Fuca.

NOAA has been working closely with the USCG on recommendations to the IMO to designate an area within 25 nautical miles off the outer coast as an ATBA. This 25 nautical mile ATBA will extend from the southern boundary of the Sanctuary north a line directly seaward from the designated lane entering the Strait of Juan de Fuca. This 25 nautical mile ATBA will buy enough time, in the event of an engine failure aboard a vessel, for a tug to intercept the eastwardly drifting vessel during a worst-case storm event before it grounds on the shoreline of the Sanctuary.

The USCG will recommend to the IMO that an ATBA be established off the western Washington coast. ATBA's are areas within defined limits in which either navigation is particularly hazardous or in which it is exceptionally important to avoid casualties, and which should be avoided by all ships, or certain classes of ships (IMO, 1991).

This action would, in effect, create a "buffer zone". This zone would provide sufficient time for responding vessels to arrive on the scene of a maritime emergency. Additionally, creation of such a zone would provide time for emergency teams ashore to be notified, contingency plans to be activated, and should there be a spill, some weathering to occur which would reduce the risk of damage to the shoreline.

The idea of establishing an ATBA is consistent with already existing voluntary vessel management practices. U.S tankers approaching the Strait of Juan de Fuca from the south are now voluntarily remaining 40-50 nm offshore until turning inbound to enter the Strait. Additionally, Canada has instituted a tanker exclusion zone affecting all U.S. tankers engaged in the transportation of crude and processed oil originating from Alaska. Several towing companies based in the Northwest region currently adhere to self-imposed plans requiring their captains to remain anywhere from 10-30 nm offshore while transporting petroleum products.

In the worst case scenario described above, the fictitious tug, North Wind, chose to use the "Towboat-Crabber Lane." As exemplified in the scenario, the distance offshore provided by this lane was insufficient in the face of conditions described to allow sufficient time for response vessels to arrive on scene.

Using the drift rate for wind (3% of wind speed) previously cited, the weather conditions of our scenario, and the abetting 1.0 kt. near shore current, the average direction and speed of a disabled and drifting vessel or barge would be approximately NNE at 1.3-1.8 kts. With this, if tanker free zone limits were set at 10, 15, 20, 25, or 30 nm offshore, times to grounding would be as follows (Time of grounding = Distance offshore/speed of drifting vessel):

Distance Offshore (nm)	Time to Grounding (hrs)
10	5.5-7.7
15	8.3-11.6
20	11.1-15.4
25	13.9-19.2
30	16.6-23.1

Due to the shape of the Washington coastline and the unpredictable variables of weather and current, the calculations shown are approximations. For example, using data from Landry and Hickey (1989) personnel from NOAA's Office of Ocean Resources Conservation and Assessment Group estimate that in the conditions described, if an incident occurred further south, 20 nm west of La Push, it might be 24 hours before the barge or vessel came ashore north of Cape Alava, near Portage Head, WA.

The establishment of a 20-30 nm buffer zone within the sanctuary would alter the most direct route from the Straits of Juan de Fuca to ports such as Grays Harbor or those along the Columbia River. Five tracklines from Buoy "J" at the entrance to the Strait of Juan de Fuca to the entrance of Grays Harbor were examined to determine the extent of these differences. The tracklines were as follows:

1. Direct Route-a nearshore route covering the minimum distance possible between Grays Harbor and the Strait of Juan de Fuca.

2. 10 nm offshore utilizing the existing traffic lanes into and out of the Strait of Juan de Fuca.

3. 20 nm offshore utilizing the existing traffic lanes into and out of the Strait of Juan de Fuca.

4. 30 nm offshore utilizing existing traffic lanes into and out of the Strait of Juan de Fuca.

5. "Towboat-Crabber Lane"-established by agreement.

The following tables illustrate the difference in using these lanes. The variability in distance between the routes to and from Grays harbor is due to the use of the already established traffic lanes at the entrance to the Strait of Juan de Fuca.

Grays Harbor to Buoy "J"

Route	Distance (nm)	Additional nm
Direct Route	102	-----
10 nm Offshore	105	3
Towboat-Crabber	109.5	7.5
20 nm Offshore	114.5	12.5
30 nm Offshore	123.5	21.5

Buoy "J" to Grays Harbor

Direct Route	105.5	-----
10 nm Offshore	110	4.5
Towboat-Crabber	113	7.5
20 nm Offshore	120	14.5
30 nm Offshore	133	27.5

The above tables demonstrate that the establishment of a tanker free zone 20 nm offshore would add 12.5 nm to a transit from Grays Harbor to Buoy "J" and 14.5 nm to a transit from Buoy "J" to Grays Harbor. If the distances travelled by transiting 20 nm offshore are compared to the already existing "Towboat-Crabber Lane", the differences are even smaller, i.e., 5 and 7 nm, respectively. The additional time and distances required by using a 30 nm zone are greater but offer the option of having all petroleum and hazardous material barges remain completely outside of the sanctuary boundaries until taking up a course inbound to the Strait of Juan de Fuca.

It would not be wise to have a traffic lane further out than 30 nm as the conflict with larger and faster tanker traffic would increase the risks of collision between vessels.

From the foregoing analysis, NOAA has requested that the USCG establish a zone requiring vessels or barges transporting petroleum or other hazardous materials to remain a minimum of 20-30 nm offshore and also to begin the process for establishing an ATBA off the western Washington coast.

If the ATBA is adopted by the IMO, the impact to uses will be minimal. The 25 nautical mile zone is fairly consistent with customary barges and vessel traffic routes. According to the analysis above, the proposed ATBA will add approximately 17 nautical miles on a vessel or barge's northbound transit, and approximately 21 nautical miles on the southward transit. The

increased protection of coastal resources will benefit the tribes who depend on coastal resources for their subsistence, and the entire local economy which depends largely on tourism.

2. Sanctuary Alternative-Regulation of Vessel Traffic

a. Consequence of Impact to Resources

Regulation of vessel traffic at the present time would undermine existing management initiatives that are well coordinated between the State of Washington, and the U.S. and Canadian Coast Guards. A well coordinated management and regulatory environment for vessels entering and exiting the Strait of Juan de Fuca offers a safer environment for mariners. This minimizes the chance for vessel accidents that can harm the environment. Therefore, NOAA believes that the Sanctuary is best served by working within the existing management framework.

b. Consequence of Impact to Uses

Additional regulation of vessel traffic will create confusion among mariners in a very congested and complex environment. Further, regulations promulgated by NOAA without the approval of IMO will have no effect on foreign vessels. Exclusion of foreign vessels from a vessel traffic management regime does little to minimize the risk of a vessel traffic accident and may result in competitive disadvantage for the domestic shipping industry.

I. Fishing, Kelp Harvesting and Aquaculture

1. Status Quo (Preferred)

a. Consequence of Impact to Resources

What little data exists shows that there are some impacts to the benthic resources from roller trawling depending on the substrate (Loverich, 1990; WDF, 1985). Impacts of trawling on soft bottom include an increase in turbidity within a 24 hour period, a depression in the substrate 2-3 inches deep, and crushing of shellfish beneath the otter boards. When trawling occurs on hard bottom, there are no noticeable impacts on the benthos. The greatest impacts of trawling are noticed when trawling occurs in kelp and eelgrass beds. There is no commercial kelp harvesting occurring within the Sanctuary. A small herring-roe-on-kelp fishery is pursued by the Lummi and S'Klallam Tribes and kelp from near Neah Bay is harvested for this fishery. The Department of Natural Resources is currently working on a kelp harvesting management plan for the Strait of Juan de Fuca.

b. Consequence of Impact to Uses

Fishing activities are predicted to benefit from designation of the Sanctuary. Fishing in general has benefitted from

Sanctuary status at other sanctuaries in the program due to the protection provided to the industry and fish stocks from the impacts of ocean dumping, offshore oil and gas development, seabed mining and water pollution. Fishing in the Sanctuary is heavily regulated by other Federal and State authorities.

NOAA evaluated the possibility of proposing some additional Sanctuary regulation of fishing. However, the existing management authorities, the WDF, WDNR, NMFS, PFMC, and the Tribes have comprehensive management authority of these resources. The management regime is highly complex and well coordinated with Canada and other west coast states through the International Pacific Halibut Convention and the Pacific Salmon Treaty. Sanctuary regulation of fishing would undermine the existing international and regional regime. The species are highly migratory and direct Sanctuary management of fishing would have no foreseeable ecological benefits.

Notwithstanding the above, the absence of specific fishing regulations does not absolve fishermen from obeying not only existing State and Federal regulations but also Sanctuary regulations of general application, which are designed to protect Sanctuary resources and qualities.

NOAA may support research on the Sanctuary's marine finfish, shellfish, and algae resources, and strengthening the present enforcement capabilities of the WDF and other enforcement entities including the NMFS and the USCG.

2. Sanctuary Alternative

a. Consequence of Impact to Resources

Sanctuary regulations at the time of designation would be intended to protect identified resources at risk from the threat of fishing activities. Such regulations would require extensive consultation with affected parties and agencies. Furthermore, no major threat has yet been identified. There does not appear that any major benefit to the environment would arrive with promulgation of Sanctuary regulations on fishing with designation.

b. Consequences of Impact to Uses

Sanctuary regulations would add another set of restrictions on the currently complicated, intricately coordinated and heavily regulated fishing industry. Aquaculture and kelp harvesting remain unregulated by the Sanctuary. Any future action would be done in cooperation with relevant Federal and state agencies, particularly the WDW, the WDNR and the WDOA.

J. Navy Bombing of Sealion Rock

1. Status Quo

a. Consequence of Impact to Resources

Figure 80 compares the Navy's use of Sealion Rock from 1986 through 1992 with the use of offshore rocks and islands by nesting colonial seabirds. It is evident that the Navy's use of Sealion Rock coincides with the particularly sensitive colonial seabird breeding events. Under the status quo, the Navy will not be permitted to use Sealion Rock as a practice bombing target for A6 jets unless the Secretary of the Interior issues a new authorization.

b. Consequence of Impact to Uses

Under the status quo, there will be no impact from Sanctuary regulations on the Navy's use of Sealion Rock.

2. Sanctuary Alternative (Preferred)

a. Consequence of Impact to Resources

By prohibiting practice bombing exercises, NOAA is extending maximum protection under the authority of the MPRSA to seabirds and mammals in the Sanctuary.

b. Consequence of Impact to Uses

This alternative will have no impact on the Navy since the authorization to use Sealion Rock for bombing practice exercises has been rescinded.

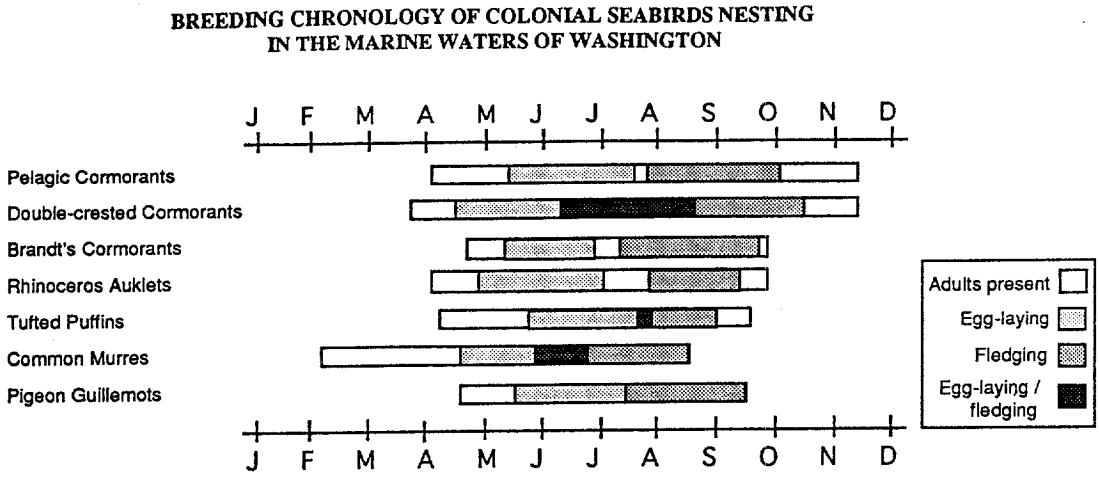
III. Section: Management Alternative Consequences

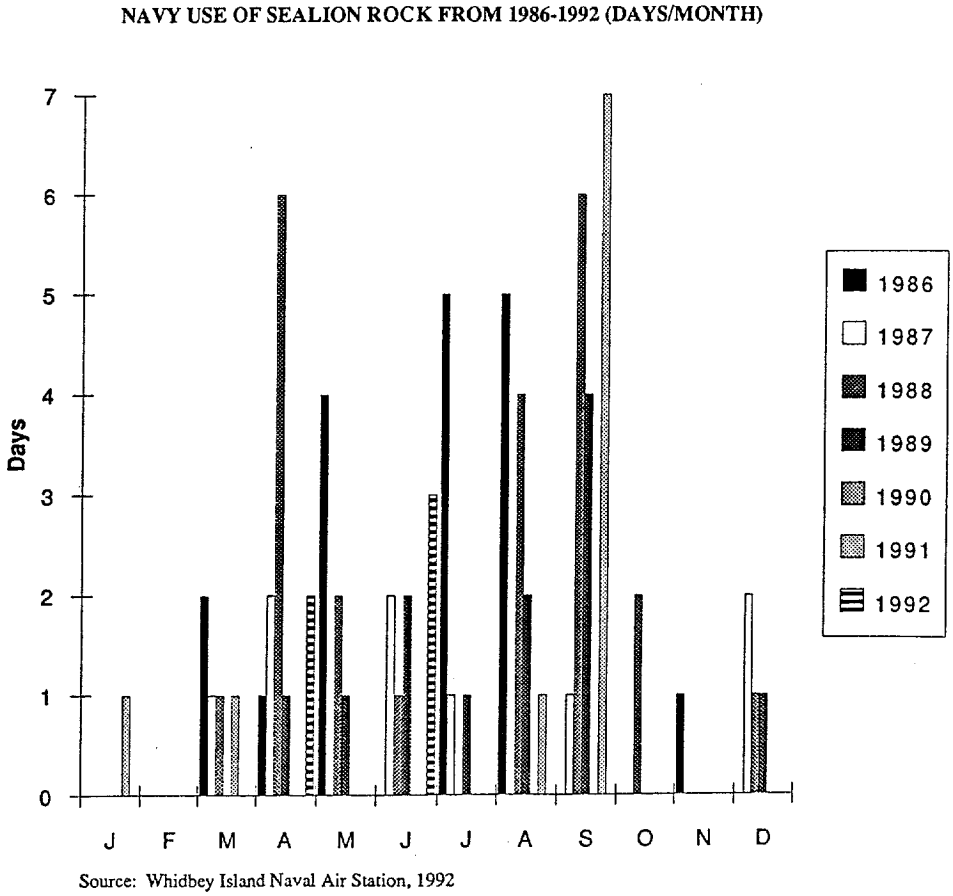
A. Consequences of Status Quo

Under the status quo alternative, protection and management of the proposed Sanctuary area will remain entirely under the existing regime of Federal, state, tribal and local authorities. No single agency will be the steward for the marine resources and ensure that all users and agencies are coordinated to protect the resources of the Sanctuary area.

1. Enforcement

A reliable and effective enforcement capability by both the Federal Government, the State of Washington, and the tribes is necessary to ensure that regulations are observed. The WDF has a total of 14 officers available to patrol offshore waters, with five actively assigned to the Olympic Coast (Westport-two; Port Angeles-two; and Clallam Bay-one). During the razor clam season, all 14 are likely to be patrolling the Olympic Coast beaches. WDF operates a 55 ft. patrol boat that enforces fishery regulations in state and Federal waters off the Olympic Coast





Source: Whidbey Island Naval Air Station, 1992

Figure 80. Analysis of Navy Overflights and Breeding seabird Activity.

during the commercial fishing season, and is on call during the rest of the year. There is also a 45 ft. patrol boat patrolling the Strait of Juan de Fuca which is available to patrol offshore if the need arises. WDF officers are deputized to enforce NMFS regulations in the exclusive economic zone.

The WDW does not routinely patrol in the area of the proposed Sanctuary; however, six officers are available to assist WDF in emergencies or when no WDF officers are available.

The USCG has primary enforcement and Search and Search and Rescue presence (personnel, boats and aircraft in the area of the Olympic Coast National Marine Sanctuary. Station offices (employing between 25-50 personnel on call to respond to emergencies) are located at Quileute River, Cape Disappointment, Grays Harbor, Neah Bay and Seattle. Group offices (with over 200 personnel offering administrative support services relevant to the area of the proposed Sanctuary) are located in Seattle, Port Angeles and Astoria, Oregon. The district office is located in Seattle, Wa.

The USCG has six large patrol boats, two large buoy tenders, three helicopters and two jets available for search and rescue and law enforcement operations. One medium endurance cutter with helicopter capability is patrolling the waters off the coastlines of Northern California, Oregon and Washington at all times. The locations of the six patrol boats stationed in the vicinity of the proposed National Marine Sanctuary are: 1) Port Angeles (210 ft. and 110 ft.); 2) Astoria (210 ft.); 3) Anacortes (82 ft.); 4) Port Townsend (82 ft.); and 5) Everett (82 ft.). The tow ocean going buoy tenders are located in Seattle (175 ft.), and Astoria (180 ft.). There are 14 smaller boats, between 40-45 ft., on call for search and rescue (three at Quileute River, five at Cape Disappointment, four at Grays Harbor and two at neah Bay). These smaller boats proceed at a maximum of 10 knots and have 50 mile offshore capability. There are three helicopters at both Port Angeles and Astoria with over 120 mile offshore capability, and two jets stationed at Astoria.

The Makah, Quileute, Hoh and Quinault Tribes have an enforcement presence within the boundaries of the Olympic Coast National Marine Sanctuary. There are 12 Tribal fishery officers in total (Hoh-1; Quinault-4; Quileute-4; and Makah-3). In addition, the Tribes operate five patrol boats in the area (Quinault-23 ft. patrol boat with radar; Quileute-23 ft. and 19 ft. boat; and Makah-44 ft. and 24 ft. boat).

The NPS employs seven full time employees to patrol the beaches along the Olympic Coast (one at Ozette; tow at Morra; two at Kalaloch; and two assistants from the Hoh Tribe). During the summer, there are five additional rangers patrolling the coastal beaches. The NPS has one zodiac available for search and rescue

missions.

The USFWS undertakes aerial surveys approximately five times per year during the spring and summer. In addition, a biologist conducts surveys in a 19 ft. zodiac three or four times per year to gather information and undertake surveillance. The USFWS and the NPS have entered into a cooperative agreement enabling the NPS rangers to provide the USFWS with information concerning violations of USFWS regulations.

The NMFS has no enforcement personnel, boats nor aircraft patrolling waters in the vicinity of the proposed Sanctuary. Enforcement of their regulations have been deputized to the WDF.

Upon consideration of available State, Federal and Tribal enforcement staff it appears that enforcement of Sanctuary regulations can be adequately addressed by the existing enforcement presence.

2. Research and Education

The existing management system contains no mechanism for maximizing the areas research value, e.g., by means of a comprehensive or extended program framework. A variety of organizations conduct significant research in the nearshore waters of the Olympic Coast. The establishment of the Olympic Center linking the terrestrial and marine ecosystems of the Olympic Peninsula has been authorized by the legislature. The National Park, USFWS and the University of Washington continue to conduct resource studies along the coast. To date, however, no coordinating entity exists to identify regional research information needs or to design strategies for filling them.

There are no marine oriented information centers on the outer coast. Thus, tourists, recreational fishermen and nature enthusiasts who visit the area have little or no knowledge of its geology or of the complex communities of biota that inhabit the canyon and surrounding waters and the intertidal habitats. Nor do they realize the value of the oceanic waters to the mammals and birds that feed there or pass through in transit.

B. Consequence of Sanctuary Alternative 1

This alternative slowly phases in the necessary management structure in parallel to the growing presence of the Sanctuary and the demands of its users. Pursuit of this alternative will not capitalize on the present momentum of the local community in support of the Sanctuary. Further, fewer staff will be able to network and coordinate research, education, monitoring and management policies programs.

1. Enforcement

Gradually NOAA would provide an enhanced enforcement regime by providing additional boats, personnel and equipment for on the water surveillance and enforcement. See the Management Plan for possible additional enforcement measures provided by the Sanctuary.

2. Research and Education

Research and education programs would not develop to their fullest potential for many years due to the lack of staff. Therefore, this alternative would not facilitate resource protection and management because the research and education components of resource protection will not be realized.

C. Consequences of Sanctuary Alternative 2 (Preferred)

This alternative supports full time staffing and immediate NOAA presence with siting of an office on the Peninsula. Given the limited NOAA budget in FY93, this would occur at the expense of specific projects. The emphasis of the staff would focus on coordination and planning with other agencies, programs and governments on the peninsula. NOAA believes that a fully staffed Sanctuary would facilitate coordination with other programs in a more rapid manner than if staffing were phased in over time.

1. Enforcement

The impact of enhanced surveillance and enforcement efforts focused on Sanctuary resources would be unnecessary at the present time. Given the extensive Federal, State and Tribal enforcement presence along the coast, and the minimal human uses, added enforcement is not the highest priority within the first year of the Sanctuary's existence.

Eventually, NOAA envisions a State-Federal-Tribal cooperative enforcement system involving the WDF, WDW, the four coastal Tribes, the USCG, the USFWS, the National Park Service and the NMFS. Since the proposed Sanctuary would include both State and Federal waters, and adjacent to Indian Reservations, close coordination between State and Federal authorities would be required.

2. Research and Education

This alternative provides full staffing, including a manager, education coordinator and research coordinator. The manager would oversee the establishment and operations of the Sanctuary Advisory Committee. The research and education coordinators would benefit from the direction provided by the Sanctuary Advisory Committee. Implementation of interpretive and

research projects and coordination with the many agencies with programs in the area would commence fairly rapidly. Establishment of a strong and complete infrastructure will provide positive momentum to the program.

IV. Unavoidable Adverse Environmental or Socioeconomic Effects

Specific environmental and socioeconomic effects of each proposed regulation are included throughout the environmental consequences section of the preferred alternative and in Part I of the FEIS/MP. The net environmental and socioeconomic effects of designating the Sanctuary and implementing the Sanctuary Management Plan and regulations are estimated to be positive. While such effects are difficult to quantify, the goals of the Sanctuary in part will be to maintain water quality, fisheries, aesthetics and tourism without causing any adverse effects.

The final Sanctuary regulations would allow all activities to be conducted in the Sanctuary except for a relatively narrow range of prohibited activities (subject to all prohibitions, restrictions and conditions validly imposed by any other authority of competent jurisdiction, and subject to the liability established by Section 312 of the Act). The procedures proposed in these regulations for applying for National Marine Sanctuary permits to conduct otherwise prohibited activities, for requesting certifications for existing licenses, permits, other authorizations or rights authorizing the prohibited activity, and for notifying NOAA of applications for authorizations to conduct a prohibited activity, would impose a cost in time and effort on the part of applicants for such permits or certifications. However, NOAA will keep such costs to a minimum by working closely with State and Federal regulatory and permitting agencies to avoid any duplication of effort and setting guidelines for expeditious review of applications.

The regulations prohibiting discharges and deposits and alteration of or construction on the seabed may require permit holders or applicants for such activities to seek other areas of disposal or apply higher levels of treatment. All measures, terms and conditions applied to existing activities will be done in consultation with the affected party and the appropriate management agency.

Estimates of revenue foregone by the prohibition of oil, gas and mineral activities within the Sanctuary boundary has been presented in detail under the socioeconomic consequences for this proposed final regulation. Balancing the foregone revenue would be the adverse environmental and socioeconomic effects avoided by the proposed prohibition. For example, the proposed prohibition may alleviate or remove matters ranging from costs to local communities for developing on-shore facilities to political and legal action resulting from public controversy and apprehension

concerning proposed oil and gas activities.

It is not possible to quantify the positive socioeconomic effects of prohibiting OCS oil and gas activities. The recent NAS study (1989) on the Adequacy of Environmental Information For Outer Continental Shelf Oil and Gas Decisions: Florida and California found that "few data have been collected by MMS or anyone else to address the social and economic impacts of OCS activities."

V. Section: Relationship Between Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity

Sanctuary designation emphasizes the importance of the natural and historical resources on the Olympic Coast area. The marine waters off the Olympic Coast is relatively pristine and the healthy and diverse natural ecosystem is relatively unaltered. Designation will enhance public awareness of the area and provide long-term assurance that its resources will be available for future generations. Implementation of the preferred alternative ensures that changes in use patterns evolve in a manner that protects the quality of the natural environment.

The education, research, and resource protection programs will provide information, management and protection that develops a foundation for wise public use of the area and results in long-term productivity. Similarly, information collected in the research program will assist marine resource managers in making better management decisions that will result in mitigation of use conflicts and adverse effects of human activities.